1 EDITORIAL

It is that time of year again, and in one way it seems only the blink of an eye, rather than a full year, since I compiled the final EARSeL Newsletter of 2000. On the other hand, when I consider the catastrophes that afflicted humanity in 2001, and in particular the recent terrible events in the United States and Afghanistan, then this time last year seems to be a very long time ago indeed.

Despite the horrors which unfolded in the world during 2001, it was another eventful and positive year in the field of Earth observation. EARSeL had an especially busy and successful year. A new EARSeL Bureau was elected in May, led by Prof. Dr. Eberhard Parlow (University of Basel), who succeeded Dr. Robin Vaughan. The 21st EARSeL Annual Symposium was held in Noisy-Champs (Paris) on 14-16 May, and was a great success. The various EARSeL Special Interest Groups (SIGs) were very active, with two major workshops (on "Forest Fires" and "Geological Applications") being held, several proceedings and CD-ROMS of previous workshops published, and various forthcoming workshops announced. (For information on how to obtain EARSeL "eProceedings", contact the EARSeL Secretariat – see page 1 for details). All in all, the smooth running and success of EARSeL in 2001 was largely due, as always, to the enthusiastic and efficient "engine" of EARSeL, Madeleine Godefroy.

It was also an industrious twelve months for the EARSeL Newsletter, with four issues containing many articles (143 to be exact!) featuring the whole gamut of topics of interest to Europe's remote sensing (RS) and GIS users. These articles have included: "pan-European" news from the European Space Agency (ESA) and European Commission; news on EARSeL's activities; technical and scientific articles; updates on developments in the RS-GIS commercial sector; many reviews / previews of meetings, reports, and books. Each Newsletter has also contained articles on how my own organisation, the Joint Research Centre (JRC), uses RS-GIS to support EU policy-making.

This issue of the Newsletter includes articles on, for example: the recent ESA Council meeting in Edinburgh, Scotland, on Europe's future role in space; ESA's soon-to-be-launched ENVISAT satellite; the EUROLANDSCAPE project of the JRC's new Institute for Environment and Sustainability; the EUROLANDSCAPE activity dealing with European Forest Biodiversity; reviews (9) and previews (6) of major international RS-GIS conferences and workshops; Wim Bakker's observations on the latest and impending space satellites forming part of the Earth-observing constellation orbiting our planet.

Finally, I would like to draw your attention to one very important Earth-orbiting vehicle, not featured elsewhere in this Newsletter, but which is nonetheless scheduled for launch around midnight on 24th December from Lapland (see image below). On behalf of EARSeL, I would like to wish you all a Merry Christmas and a very happy and peaceful 2002…

The Editor

2 NEWS FROM THE ASSOCIATION AND ITS MEMBERS

2.1 In Memoriam: Prof. Francis Cambou

Many of our long-standing members will remember our first Secretary General, Professor Francis Cambou, who has recently passed away following injuries sustained in a road accident. Professor André Lebeau, a co-founder of EARSeL and friend of Francis Cambou for many years, has sent us the following text.

With the demise of Francis Cambou, EARSeL loses one of its founding fathers.

Both he and myself recognised the necessity to create this association in order to bring together, at the European level, researchers and laboratories which were scattered in very diverse academic structures, between which it was not easy to establish means of communication and co-operation. The first informal meeting, organised by Francis Cambou, took place in the offices of the Minister for Research, Jean-Pierre Soisson, in Paris, and the first official meeting was held in September 1976 in Lyngby, Denmark, organised by Preben Gudmandsen. Present at that meeting were, among others, Johann Bodechtel, our sadly missed Georges Fraysse, Jean-Pierre Massué, as well as André Boulloche, a former minister, who represented the Council of Europe, and J. A. Dinkespieler, Director of the Joint Research Centre in Ispra. Francis Cambou was elected as Secretary General, and remained in that position until 1983.

The first EARSeL Secretary General, Professor Francis Cambou, who died recently

The creation of EARSeL is just one element of a long and brilliant career devoted to space research. From the beginning of the French space effort, in the early 1960s, Professor Cambou played a fundamental role, notably by establishing one of the very first space research laboratories, the Centre d'Etude Spatiale des Rayonne-ments (CESR) in Toulouse. Under his guidance, the CESR would find in Franco-Russian co-operation a field of activity that brought it to the forefront and enabled it to acquire the international notoriety that it has today.

As a teacher, which he remained throughout his career, he exercised important responsibilities as Director of the Institut Universitaire of Toulouse and as Director of the Conservatoire National des Arts et Métiers in Paris. He established the CNES Summer Schools, where so many famous professors have taught and from which so many long-standing links have been established.

But for myself, who had the privilege of being his friend for many years, and for all those who knew him, it is the warmth of his friendship and his unfailing loyalty that will always remain in our memories.

2.2 22nd EARSeL Symposium and General Assembly

The response to the Call for Papers for the 22nd EARSeL Symposium and General Assembly, which will be held in Prague, Czech Republic, on 4-6 June 2002, has been very good. The Preliminary Programme is expected to ready early in the New Year. Full details concerning the organisation, social events, etc. can be found on the EARSeL web-site: www.earsel.org/earsel_events.

Please note the following additions to the original schedule for the Symposium:

- The Symposium will be followed on 7 June by a specialist workshop entitled "Remote Sensing for Environmental Modelling", organised by Dr. Jan Kolar (e-mail: kolar@fsv.cvut.cz).
- During the Symposium, an additional session entitled "Observing Urban Spatial Dynamics" will be held, organised and chaired by Prof. Feliz Sunar Erbek of Istanbul Technical University, Turkey.

2.3 News from the Special Interest Groups

2.3.1 SIG Geological Applications

Report on the ESF (European Science Foundation) Exploratory Workshop "Natural Hydrocarbon Seeps, Global Tectonics and Greenhouse Gas Emission", held in Delft, The Netherlands on 27-28 August 2001.

Prof. Dr. F. D. van der Meer (Workshop Chairman), ITC, The Netherlands

Introduction

On 27-28 August 2001, a workshop, made possible by the European Science Foundation (ESF) with co-sponsoring by the Space Research Organisation of the Netherlands (SRON) and industry, was organised on the theme "Hydrocarbon seeps, global tectonics and greenhouse gas emission". The initiative arose partly from the EARSeL Special Interest Group (SIG) Geological Applications. The workshop was held at the Department of Applied Earth Sciences (Faculty of Civil Engineering and Geosciences) of the Delft University of Technology.

Background

The occurrence at the surface above oil and gas reservoirs of hydrocarbon seeps suggests that reservoirs leak. Hydrocarbon macro-seepages refer to the visible presence of oil seeping to the surface, whereas hydrocarbon micro-seepages are invisible trace quantities of light hydrocarbons seeping to the surface. Seepage is perceived as a near vertical process resulting in hydrocarbons migrating along chimneys. However, more research is needed to be able to accurately model the buoyant flow of light hydrocarbons to the surface and hence predict their expression at the surface.

Seeps (macro and micro) are important in prospecting for oil and gas. However seeps are also sources of gases, such as methane and carbon dioxide, which contribute to the greenhouse effect. Data of their emissions are potential inputs into global change models. The emission fluxes and quantities of emitted gases due to seeps are, however, at present unknown, and no method exists to monitor emissions from these vents. Much research has been done on the detection and monitoring of offshore micro-seepages, whilst relatively little work has been done on the detection of onshore micro-seepages and monitoring of the related emissions.

Aims of the workshop

The aims of the workshop were: (a) to establish a platform for a world-wide global correlation programme on hydrocarbon seep management and monitoring; (b) to define a common area for testing and integrating various methods for seep detection and monitoring. Specifically, the workshop aimed to understand better the processes involved in seepage, and the relation between hydrocarbon seeps and the local and regional geology and tectonic setting in three dimensions.

Ultimately the workshop should provide a means of extrapolating to global estimates the areal extent of seep-affected areas and emissions. The workshop should answer

very basic questions on seep distribution world-wide in relation to local, regional and global tectonics. Also we envisage that increased collaboration in this field will lead to estimates of global ethane and methane production from leaking oil and gas reservoirs. At present no quantified numbers exists on methane production from hydrocarbon seeps. However it is known that various such sources exist, which contribute a sizeable amount of emission to the global carbon cycle, adding to global warming. Hence the integration of available data on seep-related gas emissions contributes to better global change models. New innovative research proposals will be generated that integrate surface and sub-surface measurements of seep and gas emissions, and correlate onshore and offshore data with regional and global tectonic and reservoir models.

Summary of the workshop

The workshop programme was structured to reflect the issues at stake. The following thematic sessions were organised: (a) Greenhouse gas emission rates; (b) Seismic modelling of seeps; (c) Tectonic controlling factors of seeps (two sessions); (d) The Oil Mud volcanoes of Azerbaijan; (e) Surface monitoring of seeps; (f) Gas hydrates and carbonate mounds; (g) Forum discussion.

Critical issues for studies of fluid seeps at continental margins and for research on offshore seep detection and monitoring which were identified during the workshop were:

- The relation between seeps and plate tectonics
- Fault pressures in relation to emission fluxes of ethane and methane
- The rate of seepage and the flux of hydrocarbons from seeps
- The fact that seeps are small, episodic and ephemeral
- Connecting the sub-surface fluid flow to surface seepage

Likely methods which the workshop found to be suitable for study seeps are: satellite remote sensing; sonar backscatter; geochemical sniffer surveys; detecting anomalies in temperature and water chemistry; and the study of anomalous biological communities.

A proposal is presently being formulated for submission to the ESF, for a scientific network to address the above issues. In particular the network aims to bring together scientists working on the detection and monitoring of hydrocarbon emissions related to oil and gas reservoirs. Various groups of scientists are working independently of each other, and with very limited access to each other's data and understanding of their methods. Some groups focus on offshore, others on onshore seeps. Some use field surveying techniques, subsurface exploration methods, sonar and other remote sensing data, and others use geochemical approaches. At present no forum exists where these research groups can interact and exchange and integrate data and results of their studies. With a specific focus on onshore petroleum leakage, and with a firm grasp on the tectonic mechanisms underlying seeps, we envisage the promotion of European-wide integration through the network.

For more details on the workshops, visit the web-site: www.hyperspectral.ta.tudelft.nl. For details on the ESF network, please contact the organisers: Prof. Dr. F. D. van der Meer, Workshop Chairman (e-mail: f.d.vandermeer@citg.tudelft.nl); Dr. K. H. Scholte, Workshop Co-Chairman (e-mail: k.h.scholte@citg.tudelft.nl).

2.3.2 SIG RS of Land Ice and Snow

Preview of the 3rd EARSeL Workshop "Observing our Cryosphere from Space: Techniques and Methods for Monitoring Snow and Ice with Regard to Climate Change", to be held in Berne, Switzerland, on 11-13 March 2002

Dr. Stefan Wunderle, University of Berne, Switzerland

The next workshop of the EARSeL Special Interest Group "Remote Sensing of Land Ice and Snow" will take place in Berne, Switzerland on 11-13 March 2002. The Department of Geography, University of Berne, are making their facilities available to host the workshop participants. The workshop is on the theme "Observing our Cryosphere from Space: Techniques and

Methods for Monitoring Snow and Ice with Regard to Climate Change" and will bring together remote sensing (RS) specialists from Europe and the US to exchange ideas on new methods of RS of snow and ice, as well on the implementation of RS-derived snow and ice products in hydrological and climate models. To date, twenty-four abstracts have been submitted from the US, France, Norway, Germany, Sweden, Italy, Finland, Austria and Switzerland. These cover the following themes: calibration / validation of sensors; climate change; hydrological models and run-off forecasting; snow monitoring; snow models; glacier monitoring; glacier mass balance. The authors utilise SAR data and data from Landsat TM, MODIS, NOAA-AVHRR, and Laser Scanner. The invited speaker, Hans F. Graf of the German Climate Research Centre, Hamburg, will open the workshop with a talk entitled "Local and global snow cover modelling and its influence on model sensitivity".

Writing these sentences, I recall the 1st and 2nd workshops in Freiburg 1997 and Dresden 2000, with the high quality of presentations and the outstanding atmosphere during and after the sessions. It seems that the mixture of field campaigns in an uncomfortable environment, and the processing of remote sensing data in an air-conditioned laboratory using the latest technologies, brings the scientists to a common and ice-breaking climate. It is a pleasure for me to organise, together with Madeleine Godefroy and Thomas Nagler, the 3rd EARSeL Workshop of the SIG "Remote Sensing of Land Ice and Snow". I am looking forward to welcoming you to Berne in 2002! Programme details are available from myself (e-mail: swun@giub. unibe.ch).

Note that the Proceedings of the 1st workshop are available in hardcopy. Those of the 2nd workshop, held in Dresden, are published in the EARSeL eProceedings series on CD-ROM, together with the Proceedings of the EARSeL Workshop on Lidar Remote Sensing of Land and Sea. Participants and EARSeL Member Laboratories will each receive a copy soon. Copies may also be purchased from the EARSeL Secretariat. The price of the CD-ROM is 16 euros, including postage and packing.

2.3.3 SIG Developing Countries

The Second Announcement of the 2nd EARSeL Workshop on Remote Sensing for Developing Countries is included with this Newsletter. The full text and details can be found on the SIG web-site: www.rsrg.uni-bonn.de/earsel_2002/index.htm. Deadline for abstracts is 31 January 2002. For information, contact Prof. Dr. G. Menz (e-mail: menz@rsg.uni-bonn.de). Abstracts should be sent to Dr. H. P. Thamm (e-mail: thamm@rsg.uni-bonn.de).

2.4 New EARSeL Member: ZFL, University of Bonn

We are pleased to introduce a new German EARSeL Member: Zentrum für Fernerkundung der Landoberfläche (ZFL). This new interdisciplinary research centre was established between the Department of Geography, the Department of Plant Production, and the Centre for Development Research, at the University of Bonn. The aim is to strengthen the remote sensing activities of the university by concentrating facilities and knowledge within ZFL. Scientists and students from various subjects find a platform for their research activities in a sophisticated and well-equipped remote sensing laboratory. Besides research, the activities comprise education and consulting. ZFL staff offer courses in Master and Doctoral programmes, as well as assistance for research projects.

ZFL research activities cover applied research (e.g. precision farming, yield estimation, land cover change, remote sensing of snow and ice) as well as basic research topics (e.g. generating DEMs, investigation with new sensors, data fusion, time-series analysis, evaluation of high resolution data in urban areas). The utilised sensors range from the optical to the microwave spectrum. Actually, ZFL members are Principal Investigators for the SRTM and ENVISAT missions. Results from remote sensing analysis are combined with modelling approaches to achieve the aims of the studies. In particular, the integration of remote sensing in statistical, physical and bio-physiological models is one of the main research objec-

tives. Current research projects are sponsored by the German Ministry of Education and Research, the German Research Council, the State of Nordrhein-Westfalen and the German Academic Exchange Service.

More information is on the ZFL web-site: www.zfl.uni-bonn.de. The EARSeL representatives at ZFL are Prof. Dr. G. Menz (e-mail menz@rsrg.uni-bonn.de) and Dr. Matthias Braun (e-mail: matthias.braun @ipg.uni-freiburg.de).

3 NEWS FROM ESA, THE EC AND INTERNATIONAL ORGANISATIONS

3.1 News from ESA

3.1.1 Envisat Gets Ready for Launch

Niall McCormick, Institute for Environment and Sustainability, LUC Unit, European Commission, DG-JRC, Italy

ESA confirmed in September that its eagerly awaited Envisat satellite will be the next passenger on the Ariane 5 rocket, which is scheduled for launch in mid-January 2002. The last launch of Ariane 5, on 12 July 2001, ended in failure. However, ESA's announcement comes following the identification by an Enquiry Board of the sole cause of the failure – i.e. the non-ignition of the motor of Ariane's EPS (Storable Propellants Stage) component. The EPS problem has been fixed, and so the go-ahead was given for the ENVISAT launcher assembly at CSG (Centre Spatial Guyanais), the Ariane Space Centre in Kourou, French Guyana. In view of the imminent launch of ENVISAT, it is worth providing a brief re-cap on the technical attributes of this important addition to the squad of Earth observation satellites.

Envisat (Earth Observation Environmental Satellite) is an advanced polar-orbiting Earth observation satellite which will provide measurements of the atmosphere, ocean, land, and ice over a five-year period. Envisat has an ambitious and innovative payload that will ensure the continuity of data measurements of ESA's ERS (European Remote Sensing) satellites. Indeed, Envisat is seen as a continuation and enhancement of the ERS missions. The data from Envisat will support Earth science research and allow monitoring of the evolution of environmental and climatic changes. The data will also facilitate the development of operational and commercial applications.

The Envisat satellite was built for ESA by three prime contractors: ASTRIUM Ltd., UK (satellite and polar platform), ASTRIUM GmbH, Germany (instruments), and ALCATEL, France (payload data segment). The total cost of the development programme, including launch, is put at 2000 million Euros. The operational cost is estimated at 300 million Euros for the five years of the satellite's life-time. The truck-sized Envisat satellite carries ten instruments, powered by a 70 m2 solar array generating 6kW of electricity. The ten instruments on Envisat are the following:

- An Advanced Synthetic Aperture Radar (ASAR), able to image the Earth day and night.
- A Radar Altimeter (RA-2) primarily for topography of the ocean, ice, and land surfaces, with three complementary instruments for corrections and precise orbit provision: MWR (Microwave Radiometer); DORIS (Doppler Orbitography and Radio-Positioning Integrated by Satellite); LRR (Laser Retro-Reflector).
- Two imaging optical instruments for analysis of the ocean and coastal water, marine biology, pollution monitoring, and precise surface temperature determination: MERIS (Medium Resolution Imaging Spectrometer); AATSR (Advanced Along-Track Scanning Radiometer). Both instruments will also provide land vegetation monitoring.
- Three complementary instruments for detailed observation of the atmospheric layers and the density of the gas traces in

these layers: MIPAS (Michelson Interferometer for Passive Atmospheric Sounding); GOMOS (Global Ozone Monitoring by Occultation of Stars); SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric Chartography).

Envisat will have a near polar sun-synchronous orbit, with a mean altitude of 800 kilometres and a 35-day repeat cycle. Regarding data transmission, Envisat will have Ground Links direct to stations or relayed via the European Data Relay Satellite (i.e. ARTEMIS).

The above information is mainly from ESA's Envisat Information Pack, which includes documents, transparencies, and a CD-ROM. For further information on Envisat, or the Information Pack's availability, contact Jocelyne Landeau-Constantin, Head of Public Relations Office, European Space Agency, Robert-Bosch Str. 5, D-64293 Darmstadt, Germany. Telephone: +49-6151-902696. Fax: +49-6151-902961. E-mail: Jocelyne.Landeau-Constantin@esa.int. Web: envisat.esa.int

3.1.2 First Laser Link between Artemis and SPOT 4

On 22 November 2001, the first ever optical data transmission link, using a laser beam, was established between two satellites: ESA's advanced communication satellite Artemis, in a temporary orbit at 31,000 km, and the CNES satellite SPOT 4, orbiting at 832 km. The aim is to send SPOT images in real time to the Spot Image centre in Toulouse, France, via Artemis, thus drastically reducing the time between image acquisition and delivery to the centre. The operational data link between Artemis and SPOT should start in mid-2002, when Artemis reaches its final geostationary orbit (at 36,000 km). Further information is at the ESA web-site: www.esa.int. See also Section 4.1 in this issue.

3.1.3 Member State Ministers Endorse ESA's Plans

On 15 November 2001, the ministers responsible for space affairs in the countries that make up the ESA (European Space Agency) – its fifteen member states and Canada – concluded a two-day meeting in Edinburgh of the Agency's ruling Council, by endorsing the next stages in a series of ongoing programmes and committing to new initiatives that will help keep Europe at the forefront of space science and technology, Earth monitoring from space, telecommunications, satellite navigation, launchers, human spaceflight and planetary exploration.

In particular ESA and its member states made significant progress on shaping a range of future- oriented programmes, with major decisions aimed at enhancing Europe's role in the space sector. The Agency signalled its strong commitment to closer co-operation with the European Union (EU). A first Resolution highlighting the importance of a balanced, ambitious space programme serving Europe's citizens was adopted unanimously. The members agreed on a Declaration embodying financial commitments for the development of Galileo, Europe's satellite navigation system. ESA now looks forward with confidence to EU transport ministers' approval of their contribution to Galileo at their December meeting. Galileo is a major component of Europe's transport policy and will be deployed in partnership with the business sector. It will offer a wide range of independent navigation services for commercial and private users and promises to generate new commercial services in areas such as road vehicle navigation and air traffic control.

Further collaboration with the EU will focus on the Global Monitoring for Environment and Security (GMES) programme, which will address such issues as global change, natural and man-made hazards, environmental trends and monitoring of treaty commitments. Earth observation (EO) is today an essential resource for surveillance of the environment and the management of natural resources. GMES and a number of other EO projects were approved as the first elements in a series of applications missions under the Agency's Earth Watch initiative.

The delegations also decided to back a programme that will see the Ariane launcher,

which for many years now has held more than half the world market for commercial launches, evolve in terms of power and versatility. ESA is confident that Ariane will remain the world's number one choice for carrying commercial satellites into orbit. The European strategy for independent and affordable access to space is based on the provision of competitive European launch systems. The ministers stressed that to make that strategy work the right balance has to be struck between the respective roles, responsibilities and financial commitments of the public and private sectors. Restructuring of the launcher sector in Europe would be another key factor.

Concerning the ongoing discussions in the USA on the future configuration of the International Space Station (ISS), the European ministers sent a clear message to the ISS partners confirming that ESA will fulfil all of its obligations, and by the same token it expects NASA to keep to the international treaty. ESA's main interest is an intensive scientific research programme calling for specific onboard resources, one being the presence of full-size crews. One of the Resolutions passed by the Ministers, concerning ISS utilisation, provides the financial resources required by ESA but makes release of the final 60% conditional on NASA's confirmation of the original agreement.

The Science Programme is the backbone of ESA's activities – its highly successful missions have made Europe a world leader in space science. The outcome of the meeting ensures that science at ESA will remain a European flag-carrier, contributing to our knowledge-based society.

Telecommunications satellites provide services that enhance many aspects of our lives, and Europe already provides more than a quarter of the world's commercial platforms. The ongoing ARTES programme will lead to new services and offers the prospect of continuing commercial success in a rapidly evolving market.

ESA and the European Commission – towards closer ties

Europe now needs to exploit the strategic potential of space systems more effectively to further its scientific, economic, social and political objectives. The ministers acknowledged this in Edinburgh by renewing and expanding ESA's mandate to establish closer ties with the European Union.

The process of wedding the public policy objectives of the EU and the capabilities of ESA got underway some years ago. ESA is increasingly committed to closer co-operation with the EU to further its aim of putting space at the service of European citizens and also to focus attention on space at the highest political level in Europe. Pursuing these goals ESA and the EU are now engaged in the development and implementation of a truly European space policy. The foundations of that policy were laid in November last year, when the ESA and EU Councils endorsed a joint document on a European Strategy for Space.

As Europe grows, ESA is bound to grow too: the recent accession of Portugal, the interest expressed by Greece in becoming a member state, and the intensifying co-operation with Central and Eastern European countries all testify to the continuing vitality of the Agency and its programmes. Furthermore, co-operation extends beyond Europe, with last year's renewal of Canada's long-standing Co-operation Agreement with ESA and an expansion in joint work on facilities and programmes with the United States. Japan and ESA are working together closely in Earth observation and science. The existing co-operation arrangements with Russia will be further developed in areas of benefit to Europe. Ventures involving emerging spacefaring nations – notably in the Asia-Pacific region and in Latin America – are also on the ESA agenda.

Outstanding space programmes are only possible with a strong technology base, the key to the competitiveness of European industry in world markets. The ministers sought therefore to underline the importance of deriving maximum benefit from technology, with measures to encourage technology transfer and spin-off. The ministers expressed appreciation for ESA's efforts in co-ordinating communication and education programmes and in encouraging young people to widen their career hori-

zons. They urged the Agency to make European citizens more aware of the knowledge and benefits they can derive from European-led space research.

This article is from ESA Press Release No. 65-2001 ("Space serving European Citizens"), from 15 November 2001. For more information go to ESA web-site: www. esa.int

3.1.4 Update on ERS-2

The ERS-2 satellite is still performing well after more than six years of operations. Following some problems related to the pointing accuracy of ERS-2 during the first months of this year, ESA has implemented software upgrades to improve the imaging capabilities of the satellite. As a result, all delivered products will have no more than +/-5 km shift in azimuth, and corner coordinates will be correct to the frame location. Furthermore, the orbit is guaranteed to be within +/-2 km of nominal for the entire orbit, and +/-1 km between 30 and 50 degrees north. This means that applications requiring image products will be feasible, and derived products will be compliant to ESA standards and consistent with data in the archives. Differential Interferometry is still not feasible due to the orbit instability, impacting the repetivity of the orbit yaw pointing. Investigations are being carried out by ESA to improve this situation. This situation is being closely monitored by Eurimage, together with ESA. Progress reports will be put on the Eurimage web-site: www.eurimage.com.

3.2 News from the EC

3.2.1 JRC's Forest Biodiversity Activities

Forest Biodiversity Assessment in Europe: an Update on JRC Activities

Pamela Kennedy and Janna Puumalainen, Institute for Environment and Sustainability, LUC Unit, European Commission, DG-JRC, Ispra, Italy

There has been a number of developments over the past two years in the field of assessing and reporting on the biodiversity of European forests at national and European scales. The engagement of the Land Use – Land Cover (LUC) Unit in this process – with special reference to remote sensing aspects, and including a summary of a recent expert meeting at the JRC – is reviewed below.

Assessments and indicators at the level of Europe

Generally, the LUC Unit is engaged in the testing and developing of forest biodiversity indicators, as well as assessing the state-of-the-art in Europe by using various indicators. The activities are carried out both in-house and as contract work. Last year, the UN-ECE / FAO Forest Resources Assessment of Europe, CIS (Commonwealth of Independent States – i.e. the former Soviet republics), North America, Australia, Japan, and New Zealand was published (UN-ECE 2000). These data have been utilised at the LUC Unit for the preparation of a report describing the structural, compositional and functional characteristics of Europe's forest biodiversity (Puumalainen, 2001). The unit is also directly supporting the work of the Ministerial Process on the Protection of Forests in Europe through a working group primed with the task of defining methods at a pan-European scale. This working group reports to the European Topic Centre for Nature Protection and Biodiversity / European Environmental Agency. Some of the ideas under development include the assessment of forest fragmentation and mapping of forest types. Both of these include a remote sensing component.

Mapping the distribution of forests in Europe

Recently, remote sensing data have been used to compile two pan-European databases on the distribution of forests. These projects were carried out by two consortia, one led by VTT (Technical Research Centre of Finland) and the other by GAF Germany. The databases are based on AVHRR and IRS-P3 WIFS imagery, respectively. In the first approach, a method for producing a raster database, where forest proportion is estimated for each pixel element of the imagery, has been developed. The resulting database could also be referred to as a forest

probability database, as the value of the pixel gives the probability that a randomly selected point within the pixel is forest. In the second approach, three forest classes (predominantly broadleaved, predominantly coniferous, and mixed forests and other wooded land) have been distinguished with an overall accuracy of 78%. The databases are currently being used for integrated landscape and landscape diversity assessments at the European level.

Mapping the habitat suitability of certain key species

Remote sensing data can assist in the assessment of habitat suitability for certain key species. The distribution and abundance of resources and other prevailing conditions vary in space and time, and therefore no organism is randomly distributed in the landscape. This relationship between the landscape structural characteristics and species inhabiting the area justifies the habitat monitoring approaches. In a LUC Unit financed project, a consortium led by SLU (Swedish University of Agricultural Sciences) defined the species ecological profiles in Italy, Germany, Finland and Sweden, for 2-4 selected key species – e.g. moose, capercaillie, kite, wild boar, and flying squirrel. The life requisites were transformed into the model variables of a habitat suitability index model. Then, the spatial distribution of suitable habitats for a species was modelled by using spatial analysis techniques, and data from Landsat TM images and field measurements, combined by applying the K Nearest Neighbour method. The modelling results were compared with expert knowledge of the real species distribution in the area, and the distribution was in most cases found to correspond to the empirical knowledge.

Expert meeting at JRC, Ispra, Italy (29-30 October 2001)

On 29-30 October 2001, a group of thirty experts from various European organisations and research institutes, met at the JRC in Ispra, Italy, to deal with the assessment and monitoring of the biodiversity of Europe's forests. The meeting was a follow-up to the meeting at the JRC's ex-Space Applications Institute, in Ispra, in March 2000 (i.e. "Contribution of EO data and GIS Techniques for Assessing the Structural and Biological Diversity of the Forests of Europe: a Landscape Approach"). This time, the scope was to assess and discuss the progress made in various European and national projects, to initiate discussions and consolidate proposals for future activities in the upcoming 6th Research Framework Programme of the European Commission, and to provide insights into three "special" topics, namely the link between forest biodiversity and ICP-Forests (International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects in Forests), protected forests, and forests seen from a landscape perspective. The results of the meeting will be compiled in a monograph, focused on holistic biodiversity monitoring at the landscape scale. It will be available in April 2002.

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Puumalainen, J. 2001. Structural, compositional, and functional aspects of European forest biodiversity. Joint UN-ECE and JRC Publication. Geneva Timber and Forest Discussion Paper 22.

Europe's forests provide many essential products…

3.2.2 JRC's EUROLANDSCAPE Project

Sten Folving and Niall McCormick, Institute for Environment and Sustainability, LUC Unit, European Commission – DG-JRC, Italy

Land cover and land use – i.e. the composition, structure, and use of the landscape – have a major impact on the water balance, for example, and are fundamental for the diversity in habitats for flora and fauna. Forest and other wooded land cover 40% of the EU's land surface, and grasslands cover a further 16%. These two permanent land-cover types house the majority of the biodiversity in Europe, and are also our most important assets in binding carbon and thereby play an important role in reducing CO2 emissions in the EU. The other major element of the European landscape is the urban component: it is estimated that around 80% of the Europe's population live in towns or cities.

The EUROLANDSCAPE (Geo-Information for Development and Environmental Monitoring) Project is one of the three main projects that are carried out at the newly formed Land Use – Land Cover (LUC) Unit of the JRC's Institute for Environment and Sustainability. (The other two projects in the LUC Unit are "GI&GIS: Harmonisation and Interoperability" and "Natural Hazards"). EUROLANDSCAPE aims to provide harmonised European or Pan-European information on important aspects of the landscape. Thus, EUROLANDSCAPE focuses on the study of forests, other wooded land, grasslands, the urban environment, and drainage networks and associated catchments, as well as on landscape structure in general. Analysis of the socio-economic importance of various land cover types, and the impact on the environment of legislation, are also important. In order to address these themes, EUROLANDSCAPE is made up of four distinct projects:

- European Forestry: Mapping forest distribution, composition, diversity, and condition
- Catchment Characterisation and Modelling: Mapping, characterising, and classifying catchments
- MOLAND: Monitoring and modelling urban and regional land use development
- SCALE: Studying Complex Landscape Structures

European Forestry (project leader: Pamela Kennedy)

In the European Forestry sub-project, emphasis is placed on: (a) distribution and composition of forests in Europe (i.e. methods for the provision of geo-referenced, up-to-date information on forest resources); (b) forest ecosystem diversity (i.e. methods for assessing and monitoring forest biodiversity at different scales); (c) forest condition and the impact of environmental stress factors. These activities link up to the EU policy framework (Forestry Strategy, Biodiversity Strategy and Community Actions on Forestry), and to the EU's international commitments (Conventions on Biodiversity, Pan-European Process on Protection of Forests, covering the protection, conservation and sustainable development of Europe's forests). The following specific activities are carried out:

- At a European level, remote sensing applications offer a way to obtain harmonised and up-to-date data on forest resources. Within the EUROLANDSCAPE Project satellite imagery together with statistical data are being used in an innovative approach to estimate the probable proportion of different forest cover types within a landscape.
- A study is being co-ordinated in collaboration with DG Agriculture, to build a fully operational prototype of a reliable forest information system. The so-called EFIS (European Forest Information System) will allow the compilation, processing, analysis and dissemination of available forest information from a variety of data providers at international, national and regional levels.
- Work is being done to link and map relevant aspects of structural landscape diversity, in order to assess the habitat suitability for certain key species.
- The European forest condition database of the EU and ICP (International Co-operative Programme) is being analysed, together with other Europe-wide data sets, to study the relationships between

environmental stress factors and changes in forest condition.
- Climatic indices computed a daily meteorological database, spatially interpolated on a 50x50 km grid, together with ozone data from NILU (Norwegian Institute for Air Research), and a digital European soil database, are used to assess the probable impact of extreme climatic events or abnormal concentrations of ozone.

(A more detailed article on this EUROLANDSCAPE activity is presented in Section 3.2.1 above).

Catchment Characterisation and Modelling (project leader: Juergen Vogt)

The Catchment Characterising and Modelling (CCM) activity of EUROLANDSCAPE produces a European-wide mapping, characterisation, and classification of catchments according to surface characteristics, land cover dynamics and run-off conditions. Emphasis is placed on characterising and modelling the landscape and its processes (e.g. soil erosion, sediment dynamics, changes in landscape structure, desertification). The activity has been structured in four main working lines:

- Mapping of catchments. Here the aim is to create a European database of catchment boundaries and river courses, at a nominal scale of 1:250,000, from Scandinavia to the Mediterranean and from the Atlantic to the Urals. The development of an appropriate coding system of rivers is a further requirement for the analysis of water-related data for each catchment. Such a database is of great importance for the monitoring activities of the European Environment Agency, and implementation of the Water Framework Directive.
- Characterisation of the resulting catchments according to physiographic and socio-economic variables. This will be based on a set of fundamental multipurpose parameters, able to represent both the diversity and key features of the pan-European landscape.
- Development of a watershed typology (classification) as a necessary step for extrapolating the results of models of landscape and hydrological processes.
- Process modelling, in order to lay the ground for assessing the impact of policy, societal changes and possible climate changes on the dominant landscape processes, and for predicting likely changes in the European landscape.

MOLAND – Monitoring and Modelling Urban and Regional Land Use Development (project leader: Carlo Lavalle)

The aim of MOLAND is to provide a spatial planning tool for assessing, monitoring, and modelling the development of urban and regional environments. Specifically, MOLAND focuses on the computing urban indicators (delivered to EUROSTAT, European Environment Agency and others), and on assessing the impact of anthropogenic stress factors (particularly expanding settlements, transport and tourism) in and around urban areas, and along development corridors. Currently, MOLAND is supporting the development of the Thematic Strategy of the Urban Environment, which will form part of the 6th Environmental Action Programme of the European Community.

From a technical point of view, MOLAND is divided into three phases:

- Central to the methodology is the creation of detailed GIS databases of land use types and transport networks for the study areas, at a mapping scale of 1:25,000. The databases are typically for four dates (early 1950s, late 1960s, 1980s, late 1990s), or for two dates (mid 1980s, late 1990s) in the case of larger areas. For each study area the reference land use database (late 1990s) is created from interpretation of satellite imagery, usually from the IRS (Indian Remote Sensing) satellite (5.7x5.7m pixels), and in a few cases from the IKONOS or SPOT satellites. The three historical databases are made from data (aerial photos, military satellite images, etc.) available for these dates. MOLAND adopts the CORINE land cover legend, with a fourth, more detailed level of nomenclature added for artificial surfaces.
- Spatial analysis techniques are applied to the land use and transport databases and socio-economic data, in order to

compute various indicators of urban and regional development. These indicators are used to assess and compare the study areas in terms of sustainable development. Analysis of landscape fragmentation is also carried out. The land use and transport databases have also been used for a strategic environmental assessment (SEA) of the impact of transport corridors on the landscape.
- An urban and regional growth model has been developed. This takes as input the MOLAND land use and transport databases, as well as maps of land use suitability and zoning, and simulates future land use development under these spatial planning and policy scenarios. Here, the aim is to predict land use development under existing plans and policies, and to compare alternative scenarios in terms of their impact on future land use development.

SCALE – Studying Complex Landscape Structures (project leader: Ioannis Kannellopoulos)

The SCALE activity deals primarily with the development of new methods for studying complex landscape patterns including those areas experiencing fast changes. The methods are based on research on textural and structural image analysis and in particular on mathematical morphology. SCALE was set up primarily to assist in providing automatic or semi-automatic updating procedures for land cover mapping, such as the CORINE database. The activity contributes to other EUROLANDSCAPE activities, by providing efficient algorithms for analysing digital elevation models (DEMs) band forest cover types. SCALE is organised in six working lines:

- Development of methods for structural / morphological image processing used for the analysis of earth observation data.
- Provision of algorithms for automatically detecting land cover parcelling structure, which can be operationally integrated in mapping projects such as CORINE Land Cover (CLC).
- Development of methodologies for mapping and analysing built-up areas using Earth observation data.
- Development of faster and more reliable techniques for extracting geo-morphological and hydrological information from DEMs.
- Development of methods for measuring the fragmentation of forest compartments.

For more information on EUROLAND-SCAPE, contact the following persons at the JRC: Sten Folving / sten.folving@jrc.it (co-ordinator); Carlo Lavalle / carlo.lavalle @jrc.it (MOLAND); Juergen Vogt / juergen. vogt@jrc.it (Catchments Characterisation and Modelling); Pam Kennedy / pamela. kennedy@jrc.it (European Forestry); Ioannis Kannellopoulos / ioannis. kannellop oulos@jrc.it or Pierre Soille / pierre.soille @jrc.it (SCALE). For information the LUC Unit, go to the web-site: ams.egeo.sai.jrc.it / newluc

3.2.3 JRC Collaborates with CNR (Italy) on ERA

Dr Barry McSweeney, Director General of the European Commission's Joint Research Centre (JRC) and Professor Lucio Bianco, President of the Consiglio Nazionale delle Ricerche (CNR) have recently signed a collaboration agreement in a move to pave the way towards the establishment of a European Research Area (ERA).

The CNR is Italy's main research organisation, conducting both exploratory and applied research. The agreement focuses on research in the following areas: protection of the environment and sustainable development; food science and biomedicine; safety of informatics systems; metrology and socio-economic and prospective research. On a working level, co-operation between the two organisations will include carrying out joint projects using the same research infrastructure, temporary exchanges of scientific personnel, joint workshops, conferences and training courses and dual drafting of scientific documents and publications.

Collaboration between the JRC and the CNR is already fairly intense, with almost 100 research contracts and partnerships involving both organisations. The JRC is planning to play a catalytic role in the de-

velopment of the ERA by establishing networks in areas where European action is perceived necessary. The agreement with the CNR is part of the JRC's objective of strengthening links with major EU research institutions. Similar agreements have already been signed with TNO in The Netherlands, VTT in Finland and CSIC in Spain. For further information, go to the web-sites www.jrc.cec.eu.int and www.cnr.it, or contact Mr Giancarlo Caratti (telephone: +32-2-2961516).

This article is from the news item "JRC Paves the Way for ERA " (31-10-2001), on the CORDIS (Community Research and Development Information Service) web-site: www.cordis.lu/rtd2002/home.html. Further information on the ERA is at the web-site: europa.eu.int/comm./research/area_es.html.

3.3 OEEPE's Sensor and Data Fusion Contest

The following article is from the OEEPE Newsletter 2001 (No. 1). It is re-printed here with the kind permission of OEEPE (European Organisation for Experimental Photogrammetric Research). Further information on the activities of OEEPE is on the following web-site: www.oeepe.org.

Sensor and Data Fusion Contest: Information for Mapping from Airborne SAR and Optical Imagery

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Abstract

The concept of a sensor and data fusion contest on topographic mapping from SAR and optical imagery is presented. Potential participants are introduced to topic and test which is scheduled to be started in summer 2001. The image data to be used in the test will have a spatial resolution of approximately 1 m or better. The SAR data will be multi-frequency polarimetric INSAR data, the optical data multi-spectral. The goal of processing is the extraction of topographic objects which are commonly subject of mapping projects, e.g. roads, built-up areas and other land cover/land use classes. The final scope of the test will be defined after interaction with potential participants of the test. Besides the image data, digital reference maps will be compiled for the test sites. For this task, contributions from e.g. official mapping authorities would be very valuable.

The data fusion contest will be organised in the framework of the IEEE GRSS data fusion technical committee (DFC), the ISPRS working group III/6 "Multi-Source Vision" which both have strong relations with scientists active in research on multi-sensor fusion and automation in mapping, and - as the provider of the main organisational framework - the European Organisation for Experimental Photogram-metric Research (OEEPE) which is the research platform of national mapping agencies and other institutions regarding technology developments to optimise the use of core data in a geoinformation infrastructure context.

Keywords: data fusion, multi-sensor, test set-up, sensor contest, data fusion contest

Introduction

For mapping tasks such as the acquisition of topographic objects or the generation of digital elevation models (DEM), mainly panchromatic optical imagery is used. Yet recently, also various types of multi-spectral images have been applied allowing to acquire additional object-specific characteristics making object extraction more robust. Besides this, synthetic aperture radar (SAR) imagery has been in use for a number of years with a strong emphasis on satellite images such as data from ERS, J-ERS or RadarSat. While these images can be successfully used for a number of tasks, topographic mapping in scales such as 1:25,000 or 1:50,000 is very difficult, mainly due to the rather coarse ground sampling distance. Recently, airborne SAR images

have increasingly become available and are gaining in importance, especially when used in the interferometric mode for the generation of digital terrain models, or the polarimetric mode for the extraction of structural object information.

In this scenario of practical applications two questions are remaining: (1) Can state-of-the-art airborne SAR compete with optical sensors in the mapping domain? (2) What can be gained when SAR and optical images are used in combination, i.e. when methods for information fusion are applied? Presently, there are no clear answers regarding these questions. On the one hand, there are indications that in the future airborne SAR images will probably also play a bigger role in topographic mapping due to their major advantages, namely independence of day light and of cloud cover. On the other hand, the interpretation of SAR images is difficult for a number of reasons: the geometry and the spectral range of SAR is different to optical imagery and – what is more important – different to how the human eye works. In addition, the reflectance properties of objects in the microwave range depend on the used frequency band and may significantly differ from the usual assumption of more or less diffuse reflection at the Earth surface. This effect can be particularly strong for buildings or metal surfaces. Speckle, a consequence of the coherent radiation needed to exploit the SAR principle, and other disturbing factors further complicate the interpretation. Therefore, mapping staff such as photogrammetric operators often experience difficulties in interpreting SAR imagery for topographic mapping.

Therefore, a test on topographic mapping from SAR and optical imagery is proposed. Its aim is to study in as much detail as possible the potential of airborne SAR and multi-spectral optical imagery for topographic mapping in the scale range of 1:25.000 to 1:50.000. Based on orthoimages of one or more study area/s test participants should visually interpret the imagery on the screen, and capture the topographic objects interactively. The evaluation of the test results will be based on reference data. Besides a graphical comparison of different plots, quantitative results (e. g. the number of objects which could be detected correctly/which were labelled correctly, the geometric accuracy of the extracted objects etc.) will be determined. It will also be studied which attributes can be derived from the test data. In a second and third phase, test participants will be using automatic methods for object extraction and methods of data fusion, respectively.

Test data

The image data to be used will have a spatial resolution of approximately 1 m, or - especially in case of SAR data - better. The SAR data will be multi-frequency polarimetric interferometric data, the optical data multi-spectral. Both optical and SAR sensors will be leading-edge airborne systems being under continuous revision which is why the exact parameters of sensors and data are not yet known. The goal of processing is the extraction of topographic objects which are commonly subject of mapping projects, e.g. roads, built-up areas and other land cover/land use classes. The final scope of the test will be defined after interaction with potential participants of the test. Besides the image data, digital reference maps will be compiled for the test sites. For this task, contributions from official mapping authorities would be very valuable.

For the test, existing imagery from commercial companies or from data users/owners shall be used. Beforehand, for each data set the legal conditions of data use by the test participants have to be clarified. It would be preferable to use data which are free of charge. Regarding this matter, any information about benchmark data sets already in existence is very welcome.

Sensor and Data Fusion Contest

The test will be conducted in three phases. In phase 1, the participants will derive a visual interpretation of the data. The results will show the information content of the data independent of the performance of specific automatic object extraction methods and software. In this phase, mapping authorities commonly active in state- or country-wide mapping projects can give valuable contributions to the contest.

In phase 2, automatic object extraction procedures will be applied to each sensor's data separately. Regarding data fusion, the results will be reference data for the performance of object extraction without use of multi-sensor data. They will at the same time represent the outcome of a competition of sensors. Possibly, the question can be answered whether SAR is already an alternative means of data acquisition in mapping projects compared with optical sensors or whether it even outperforms optical sensors. In this phase, the alternative use of only partial data of one or both of the sensors may be requested from the participants. Object extraction results will be analysed by comparison with the digital reference maps. In phase 2, any party (private company, governmental authority, university or research institute) can compete successfully by presentation of results reflecting its specific expertise, e.g. in automatic extraction of a specific class of objects, or in compilation of maps fulfilling specific official requirements.

In phase 3, mapping will be conducted based on data of both sensors, i.e. by multi-sensor data fusion. This phase will give any participant interested in research on data fusion a chance to prove how valuable multi-sensor data fusion is by demonstrating the degree of improvement in accuracy, correctness, completeness, robustness, or scope of object extraction.

Organisational matters

The test will be organised in the framework OEEPE in co_operation with the IEEE GRSS data fusion technical committee (DFC) and ISPRS working group III/6 "Multi-Source Vision" which both have strong relations with scientists active in research on multi-sensor fusion and automation in mapping.

One can pursue at least three different ways to define the topographic objects to be dealt with: (1) the pilot centre defines a set of objects of interest such as roads, buildings, settlement areas etc. in the preparation phase of the test, (2) these objects are defined and agreed upon by the participants immediately after the beginning of the project, (3) each participant is free to define his own set of relevant objects which should preferably come from the national topographic data base. It is anticipated that (1) and (2) lead to a closer co-operation between the participants which is desirable. (3) should therefore only be pursued if (1) or (2) are not feasible for any reason. After collecting the results the pilot centre will have to homogenise the individual interpretation results in order to draw meaningful conclusions.

Due to the general tendency in photogrammetry and topographic mapping towards multi-sensor systems and especially due to the increasing importance of SAR in this context, the proposed test is seen as important for all groups within the mapping community. Some characteristics of the images to be used for the test, the specific image acquisition parameters (flying height, precise ground resolution etc.) and site location/s still have to be defined. It is certainly advantageous to have more than one single test site in order to be able to study a variety of phenomena. These issues should be discussed and solved in the definition phase of the project which is supposed to be started by the end of May 2001. Any party interested in participation to the contest is kindly invited to contact the first author of the paper.

Acknowledgements

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4 RS DATA, PRODUCTS AND PROJECTS

4.1 Observations

Wim Bakker, ITC, The Netherlands.

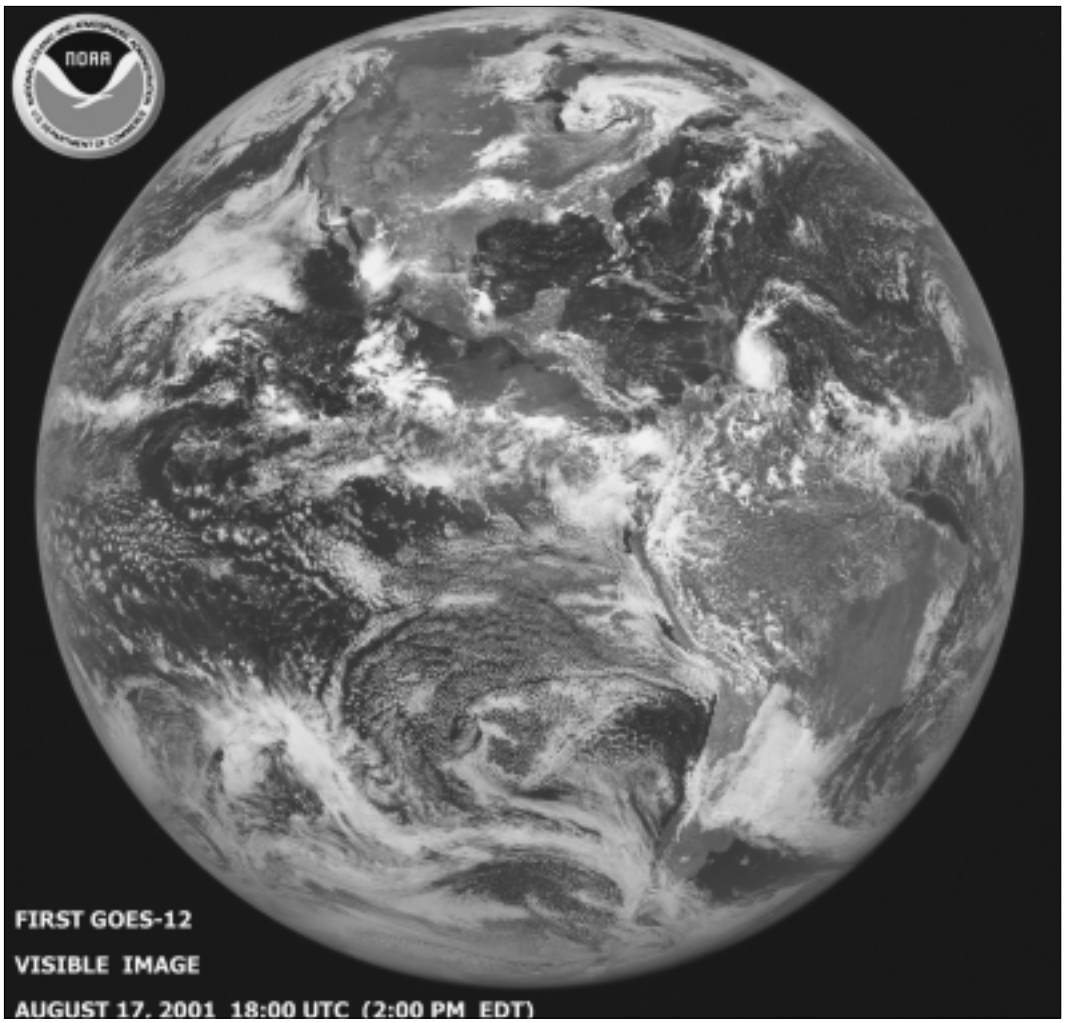
Launch news

Artemis rising

Launched on 12 July 2001, Artemis is still safely orbiting the Earth. Artemis, ESA's newest telecommunications and navigation satellite, is in good health and is orbiting the Earth at an altitude of 31,000 km. Nearly all tests that are needed before its onboard ion propulsion system is programmed to move it into geostationary orbit, have been completed successfully. All that remains is the preparation and testing of the final part of the software needed to carry out the orbit-raising operation. It has taken longer than expected to prepare this last piece of software leading to a short delay, as phase 4 of the operation to put Artemis into its correct orbit can only begin once all those responsible for its safety are sure that every possible test and control has been done. However, according to current estimates, by mid-December all tests should be completed. Once Phase 4 has commenced it will then be possible to estimate when Artemis will be able to commence 'work'.

GOES-12 first image

The GOES-12 satellite was launched on 23 July 2001, and achieved geostationary orbit on 12 August. It is the first of the NOAA satellites equipped with a Solar X-ray Im-



First image from the GOES-12 Satellite

ager (SXI), an instrument that can detect solar storms. GOES-12 will be stored in orbit and will replace either GOES-8 or GOES-10 as needed. On 17 August 2001 the satellite sent back its first clear, crisp image of the western hemisphere.

Failure of OrbView-4 and QuikTOMS

On 21 September 2001, a Taurus rocket carrying the OrbView-4 and QuikTOMS satellites was launched, but failed to place the satellites into their proper orbit. The rocket released the satellites at a lower altitude and velocity than intended and the satellites did not achieve a stable orbit.

QuikTOMS was to continue NASA's long-term measurement of global ozone levels. QuikTOMS carried only one instrument, TOMS. TOMS is a second-generation, ozone-sounding instrument derived from the Backscatter Ultraviolet (BUV) Spectrometer flown aboard NASA's Nimbus-4 satellite in 1970. The first TOMS instrument was launched aboard Nimbus-7 in 1978. The Nimbus-7 / TOMS operated almost continuously from its launch until its failure in 1993, providing more than fifteen years of daily global maps of total ozone. The Meteor-3 / TOMS, ADEOS / TOMS and the Earth Probe / TOMS followed the Nimbus-7 / TOMS. The OrbView-4 satellite was developed for high-resolution and hyperspectral imaging.

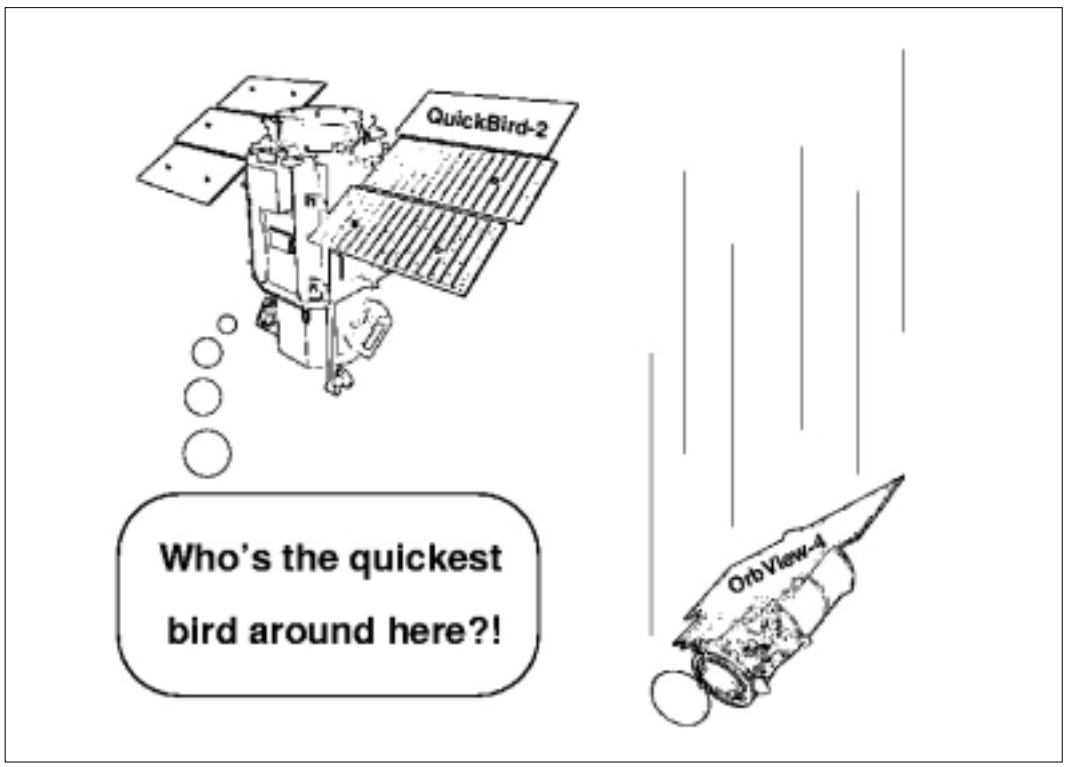
QuickBird launched

On 18 October 2001, the QuickBird satellite was launched into a sun-synchronous orbit. After an on-orbit calibration and commissioning period of about 90 days the satellite will start regular operations. With a resolution of about 60 centimetres, the satellite will provide the highest resolution commercial digital imagery currently available.

PROBA, TES and BIRD launched

In its sixth flight conducted on 22 October 2001, India's Polar Satellite Launch Vehicle, PSLV-C3, successfully launched three satellites, TES of ISRO (India), BIRD of Germany and PROBA of Belgium. All satellites are reported to be functioning well. This is the second time that the PSLV launched three satellites simultaneously. In the previous launch in May 1999, PSLV had launched India's Oceansat / IRS-P4 along with German DLR-Tubsat and Korean KITSAT-3.

TES (Technology Experiment Satellite) will be used to demonstrate new technologies



Contrasting fortunes of QuickBird and OrbView-4 in 2001

for remote sensing. BIRD (Bispectral and Infrared Remote Detection) is a small demonstration satellite by DLR for testing a new generation of imaging infrared sensors for Earth remote sensing objectives, which can be used for planetary exploration, too. CHRIS (Compact High Resolution Imaging Spectrometer) is a new imaging spectrometer on board PROBA (Project for On-Board Autonomy). The images by CHRIS cover an area of 18.6 km square, from an 800 km orbit, with a resolution of 25 metres. It operates simultaneously across nineteen fully programmable spectral bands in the range 415-1050 nanometres, with a spectral resolution better than 10 nanometres. Many more bands can be provided at reduced spatial resolution, and all bands are fully programmable from the ground. CHRIS is designed to take advantage of the latest capabilities of agile small satellites to deliver superior Earth images with multiple view angles. It is being built by Sira with support from the British National Space Center.

Birthdays

ERS – 10 years old

ERS-1 was lofted into orbit by an Ariane-4 launcher on 17 July 1991. Since then ERS-1 and ERS-2 have provided a ten-year stream of data. On 20 April 1995 the ERS-1 was joined in orbit by its sister, ERS-2. The most outstanding success of the ERS programme is the interferometry application and the later adaptation of the tandem mission for the two satellites. The tandem mission became possible because ERS-1 lasted three times as long as its design lifetime. ERS-1 is currently inactive.

Meanwhile, ERS-2 goes gyro-less. By January 2000, ERS-2 was down from six gyroscopes to limping along with one. Complete failure would make the otherwise functional spacecraft useless. A method was worked out for operating the ERS-2 equipment (sensors and actuators) in a new way, to permit gyroscope-free ERS-2 positioning. After the last gyroscope failed on 13 January 2001, new positioning software was uploaded to ERS-2.

Part of the design involved a device called the Digital Earth Sensor (DES), set to our planet's horizon for extremely basic positioning checks. DES is now used to estimate pitch and roll errors. That still left the final yaw (or downward) pointing error, which could no longer be measured by the gyro-less spacecraft. This drift is now checked by analysing Doppler frequency shifts in the ERS-2 radar instrument signals. Turning raw signal into useful data takes up to three hours however, too long to keep the spacecraft correctly orientated in real time. So instead ERS-2 was monitored over a 105-day "shakedown cruise", totalling three 35-day repeat tracks over the Earth's surface. Recurring patterns of spacecraft "de-pointing", caused mainly by terrestrial magnetic field variations as well as pressure from the solar wind, were rendered into a detailed model up-linked to the satellite. This enables de-pointing to be anticipated and compensated for.

The gyro-less technique should extend the lifespan, and preserves ERS-2 to operate with its scheduled successor Envisat-1 (January 2002) and to provide wind measurement until Metop-1 takes the relay in 2005. (Editor’s note: see article in Section 3.1.4).

IRS-1B – 10 years old

The Indian Remote Sensing satellite, IRS-1B, which was launched on 29 August 1991, has successfully completed 10 years of operation. IRS-1B gave India a valuable experience for designing and launching its follow-on satellites IRS-1C and IRS-1D, for a while considered as the world's best in terms of spatial and spectral resolution. Even after 10 years of operation, IRS-1B, will continue to be used for conducting various experiments including studying the design margins of the various subsystems and to test different modes of operation using the available fuel.

Radarsat-1 – 6 years old

Radarsat-1, Canada's first commercial remote sensing satellite, has successfully completed its sixth year in space capturing more than 220,000 images, since its launch on 4 November 1995. One of the highlights of the Radarsat-1 mission was the Antarctic Mapping Missions (AMM) conducted in 1999 and again in 2000. Building on the success of Radarsat-1, Radarsat-2 is currently under construction by prime con-

tractor MacDonald Dettwiler and Associates and is scheduled for launch late in 2003. Currently, specific modifications to the Radarsat-2 spacecraft are being implemented to support a proposed tandem mission with Radarsat-3.

Global Disco

Eros-B

The Eros-A2 spacecraft will not be launch this year, and it won't be launched after that either. ImageSat International has decided to focus all their effort on the next generation, the Eros-B satellite series. Eros-A1, the first satellite in the Eros-A series, was successfully launched in December 2000, and is currently providing services to users. The Eros-B1 satellite is scheduled to be launched by the end of 2003. The Eros-B2 to B5 satellites will follow in 2004 and 2005, to complete the constellation of commercial high resolution (0.5 metres) satellites.

Helios lifting

NASA's solar-powered Helios experimental aircraft lifted off from the Hawaiian island of Kauai on 13 August 2001, reaching a height of 29 kilometres. The 15-million dollar aircraft failed in its attempt to reach an altitude of 30 kilometres, but it broke a record set by its predecessor, the Pathfinder-Plus, for 24 kilometres for solar-powered and propeller-driven aircraft in 1998.

The record flight sets the stage for follow-on missions that will use a regenerative fuel system now under development to enable Helios to remain aloft 24 hours a day for months at a time. Production variants of Helios might see service as long-term Earth environmental monitors or as communications relays, reducing dependence on satellites and providing service in areas not covered by satellites. The successful flight at high altitude also provides NASA with information about flight on Mars, since the atmosphere at that height above Earth replicates the atmosphere near the Martian surface.

Jason-1 arrived

The Jason-1 satellite, a joint project of NASA and CNES, the French Space Agency, arrived at Vandenberg Air Force Base, California, to begin final preparations for launch on 7 December 2001. Jason-1 is the first follow-on to the highly successful TOPEX / Poseidon mission that measured ocean surface topography to an accuracy of 4.2 centimetres, enabled scientists to forecast the 1997-1998 El Niño, and improved understanding of ocean circulation and its effect of global climate.

Landsat-4 and GOES-2 retired

The Landsat-4 and GOES-2 spacecraft were retired in May and June, and placed in disposal orbits to reduce collision risks with other resident space objects. GOES 2 was left in a slightly eccentric orbit, ranging approximately 200-300 kilometres above GEO. The vehicle was successfully pacified and turned off on 5 May. The GOES 2 spacecraft, launched on 16 June 1977, provided valuable meteorological services for both the western and eastern hemispheres for many years.

Meanwhile, in low-Earth orbit (LEO), the nearly nineteen years old Landsat-4 spacecraft was nearing the end of its equally impressive extended mission. Landsat-4 was launched on 16 July 1982 into a sun-synchronous orbit. From its operational altitude near 700 kilometres, Landsat-4 would likely remain in orbit for several decades before falling back to Earth. Therefore, Landsat-4 was commanded to use its residual propellant to manoeuvre into a lower altitude disposal orbit from which re-entry will probably occur within 25 years. Manoeuvres began in early June, and by mid-June Landsat-4 was in a nearly circular orbit near 590 kilometres, greatly reducing the time the spacecraft will remain in orbit.

Meanwhile, there were prospects of government funding of Landsat-5 operations in the year 2002, but it is not clear to the author whether this money did materialise. Landsat-5, launched in 1984, is also rapidly approaching retirement. Planning is now underway to follow the lead of Landsat-4 and to transfer Landsat-5 to a shorter-lived disposal orbit.

TRMM boosted

On 22 August 2001 NASA completed a set of manoeuvres on the Tropical Rainfall

Measuring Mission (TRMM) spacecraft to boost its orbit around Earth. The push into a higher orbit will prolong the satellite's life and continue to provide meteorologists and climatologists with data to forecast and better understand global climate change. The TRMM satellite has been recording rainfall data over the tropics since it was launched in 1997.

Triana shelved

The only fully digital satellite, Triana (it will fly, it won't fly, it will fly, it won't fly...) has finally jumped to its final state. Soon it will be entombed in an aluminium box in the corner of Building 7 at NASA's Goddard Space Flight Centre. No one knows if it will ever fly.

Although members of the US Congress have ridiculed "GoreSat" Triana, Gore's plan has so far been the only initiative for a "public access" remote sensing satellite. Perhaps Triana seems so ridiculous because for too long such technologies have remained within the tight grasp of military, corporate and scientific agencies. Indeed, we can scarcely imagine a remote sensing satellite that is immediately accountable to those who lie in its field of vision. As early as 1984, however, video activist Nam Jun Paik envisioned the satellite as a public access medium when he and a handful of other artists produced a live transatlantic satellite exchange entitled "1984 / Good Morning Mr. Orwell." An event he termed "Global Disco."

4.2 Satellites Capture Birth of Large Iceberg

To the surprise of scientists, a large iceberg has broken off the Pine Island Glacier in West Antarctica well in advance of predictions. The new iceberg detached from the glacier when a crack, which initially formed in mid-2000, spread rapidly until it reached the breaking point. The iceberg's birth was captured in a series of images taken by NASA's Multi-Angle Imaging SpectroRadiometer. These images, combined with previous measurements and data from other instruments, provide scientists with additional evidence of rapid change in the region. The image sequence and an animation are available on-line at: www.jpl.nasa.gov/images/earth/antarctica. The first image was captured in late 2000, early in the development of the crack. The second and third views were acquired in November 2001, just before and just after the formation of the new iceberg.

The Multi-Angle Imaging SpectroRadiometer, built and managed by NASA's Jet Propulsion Laboratory, Pasadena, California, is one of several Earth-observing experiments aboard the Terra satellite, launched in December 1999. The instrument acquires images of Earth at nine angles simultaneously, using nine separate cameras pointed forward, downward, and backward along its flight path. More information is available at: www-misr.jpl.nasa.gov.

This article is from the JPL (Jet Propulsion Laboratory) News Release of 14 November 2001 ("Pine Island Glacier Creates a Splash"). For more information, contact Alan Buis at JPL (telephone: +1-818-354-0474), or visit the JPL web-site: www.jpl.nasa.gov.

4.3 US Earthquake Faults Studied Using ERS-SAR

Scientists at NASA's Jet Propulsion Laboratory, Pasadena, California, and the University of California, Los Angeles, have concluded that earthquake fault zones in California's eastern Mojave Desert are moving in different ways from what they expected. For years researchers were aware that movement in the southern California shear zone was distributed over a 100-kilometre (60-mile) wide area. However, they assumed that deep below the surface the Blackwater Little Lake and the Garlock faults were creeping steadily, something that the new study seems to contradict.

New findings indicate that more than half of the right-lateral motion of the eastern California shear zone is sharply concentrated along the Blackwater Little Lake fault system. The rapid strain accumulation observed along the fault system indicates that the fault is building up stress in the shallow crust at a rate three times faster than the rate inferred from geological observations.

This may be the manifestation of stress transfer between the Garlock fault and other faults in the Mojave area, in particular those that produced the magnitude 7.3 Landers earthquake in 1992 and the magnitude 7.8 Owens Valley earthquake in 1872. Scientists arrived at the conclusion after studying radar interferometry data collected by satellites over the last eight years. Radar interferometry is a method to map the topography and displacement of the Earth's surface with extreme accuracy.

A paper with the findings is in the 1 November 2001 issue of the journal Geology. "The most exciting thing is we discovered something we didn't expect. We were looking for deformation on the Garlock fault, but we saw in the image a concentration of shear along the Blackwater Little Lake fault, which cuts the Garlock fault at a right angle," said Dr. Gilles Peltzer, a UCLA professor and JPL research scientist who is the lead author of the study. "Radar interferometry has been applied previously to the study of earthquakes, and what we are imaging here is the surface strain field produced by the slow creep occurring at depth on active faults between earthquakes."

Operated by the European Space Agency, the ERS (European Remote Sensing) satellites use interaction of radar waves to measure distances and angles precisely. The satellites look at Earth in a slanted angle at 23 degrees. The only other way to gain such accurate information on fault displacement would be to place GPS receivers every 50 metres (about 165 feet).

This article is from the JPL (Jet Propulsion Laboratory) News Release of 1 November 2001 ("Earthquake Studies: Fault Moving Faster Than Believed"). For more information, contact Enrico Piazza at JPL (telephone: +1-818-354-5011), or visit the JPL web-site: www.jpl.nasa.gov.

4.4 NASA Analyses Coastal Eddies Using ERS-SAR

Two NASA oceanographers have found and described numerous coastal ocean eddies off the southern California coast, that are smaller and more abundant than previously reported. The results of the study by Benjamin Holt and Paul DiGiacomo of NASA's Jet Propulsion Laboratory, Pasadena California, also emphasise the potential importance of the eddies to local marine flora and fauna. "Eddies can serve as mini-restaurants and nurseries in the coastal ocean," DiGiacomo said. "Many organisms spend time within them feeding and developing."

Eddies, which are whirlpool-like occurrences in the ocean, can foster plant growth by supplying nutrients. They can also concentrate and transport organisms, particularly planktonic larvae and juvenile fish, carrying them to fertile coastal environments critical for survival and growth. This is the most comprehensive study to date of small coastal ocean eddies in the Southern California Bight, or the coastal ocean from Point Conception to just south of San Diego. The results of their study were published in the 15 October issue of the Journal of Geophysical Research – Oceans.

Although eddies are related to the ocean water around them, they have distinct biological and physical personalities. Visual clues to the existence of some eddies are circular slicks, or glassy water, on the ocean's surface. Deceptively tranquil, these ocean phenomena may dramatically affect the local ecosystem. The dispersal of pollutants, a significant environmental concern, can also be affected by coastal ocean eddies. Knowledge of the characteristics of these eddies can help authorities to monitor and control oil spills and coastal runoff. "Pollutants do not necessarily just get flushed out and then diluted in the ocean," DiGiacomo said. "They can even be brought back to shore depending on conditions."

The study analysed satellite radar images of the Southern California Bight acquired between 1992 and 1998. Holt and DiGiacomo took advantage of the high resolution of the radar images to map the seasonal and spatial distributions of these previously under-sampled ocean features. Field measurements acquired in the ocean with buoys, both moored and drifting, were also used to complement the satellite research. All the coastal eddies found were less than

50 kilometres (about 31 miles) in diameter, and 70% of them were less than 10 kilometres (about 6.2 miles) in diameter, considered small in the world of eddies.

Synthetic aperture radar satellite images used in the study were obtained from the European Space Agency's first and second ERS (European Remote Sensing) satellite missions. AVHRR (Advanced Very High Resolution Radiometer) satellite imagery data were obtained from the National Oceanic and Atmospheric Administration's CoastWatch Program. Representative images are available on-line at www.jpl.nasa.gov/images/earth/pacificocean

This article is from the JPL (Jet Propulsion Laboratory) News Release of 26 October 2001 ("Studying Coastal Eddies: Restaurants and Nurseries of the Sea"). For more information, contact Colleen Sharkey at JPL (telephone: +1-818-354-0372), or visit the JPL web-site: www.jpl.nasa.gov.

4.5 Definiens Imaging Releases eCognition 2.0

Definiens Imaging GmbH has announced the release of eCognition Version 2.0. One year after the successful worldwide introduction of the revolutionary approach of its new object-oriented image analysis system, eCognition, Definiens Imaging GmbH adds further functionality, performance and ease of use to its system. Driven by recommendations of eCognition customers, the needs of emerging geomatic markets in feature extraction and image exploitation, and the innovations of its team, Definiens Imaging GmbH took another significant step towards exploiting information from Earth observation data and establishing automated production chains.

The new release – eCognition 2.0 – is even more closely linked to the GIS world, in that it is able directly to read and write vector information, manage raster data of different extent and resolution, and handle geocoded information perfectly. The performance of time-consuming functions has been further enhanced. Especially some functions in the interactive display now take only few seconds – even working in near-real time. Users are now able to create new object features out of any combination of existing object parameters. Additionally, new shape features come along with the internal treatment of vector structures.

A pre-release of eCognition 2.0 was shipped to numerous international users for beta-test. The functionality of eCognition 2.0 will be shown to the public during international trade fairs in North America, Europe and Asia this autumn, while shipment to users will start from October 2001. Definiens Imaging GmbH, and its global reseller PCI Geomatics, will offer special incentives for early adapters to eCognition 2.0. More information on eCognition 2.0 is on the web-site: www.definiens-imaging.com/ecognition2/

Definiens Imaging GmbH was established in 2001, and is a subsidiary of Definiens AG. It includes all geomatics and imaging technologies and products. Definiens AG evolved in September 2000 from Delphi2 Creative Technologies GmbH, which was founded in 1994 by Nobel Laureate Prof. Dr. Gerd Binnig and science journalist Dieter Herold. Definiens develops decentralised communication platforms, as well as software, for knowledge management and image analysis. Definiens AG's solutions are based on the "Cognition Network." This basic technology closely emulates human thoughts. Definiens AG, with thirty-four employees, is based in Munich, Germany.

4.6 ERDAS Launches "Image to 3D GIS Solution"

Less than four years after it launched its first phase of photogrammetry products, ERDAS® Inc. has successfully completed its ambitious undertaking, and has released an "Image to 3D GIS Solution" Photogrammetry Product Suite. ERDAS' Photogrammetry Version 8.5.1 consists of IMAGINE OrthoBASE™, IMAGINE OrthoBASE Pro™, Stereo Analyst 1.2®, and IKONOS Sensor Model Support for ERDAS IMAGINE®. In addition to the quality photogrammetry software included in the product suite, the pack contains a comprehensive photogrammetric users guide.

ERDAS' Photogrammetry Suite creates a streamlined linear workflow, allowing users to triangulate data, extract DTMs, ortho-rectify images, and use the triangulation results and images in Stereo Analyst to perform 3D feature extraction. The extracted features and ortho-rectified frames can be displayed in an ERDAS IMAGINE viewer, used to create maps, or simply added to a GIS database.

IMAGINE OrthoBASE is a revolutionary new digital photogrammetry product that drastically reduces the costs and time associated with ortho-photo production. IMAGINE OrthoBASE performs block triangulation and ortho-rectification for a wide variety of aerial photographs and satellite imagery, including videography and 35 mm camera images.

IMAGINE OrthoBASE Pro, which is a major upgrade to IMAGINE OrthoBASE, uses sophisticated and rigorous artificial intelligence techniques to automatically extract DTMs from imagery. Digital image matching techniques, commonly used for machine vision, automatically identify and match image points that appear on overlapping areas of a stereo pair (i.e. left and right overlapping images). Once the correct image positions have been identified and matched, the elevation for the ground point is automatically computed. The extracted 3D ground points are subsequently used to create a DTM.

Stereo Analyst, with added sensor model support for IKONOS, SPOT and IRS-1C stereo imagery is designed as a stand-alone product, which can also be easily integrated with ERDAS IMAGINE and ESRI GIS products. Stereo Analyst 1.2 has the ability to interoperate with ERDAS IMAGINE 8.5. Using accurate geographic imagery, Stereo Analyst transforms 2D GIS into real-world dimensions with map-accurate 3D information. Stereo Analyst updates the GIS by superimposing existing 2D vector layers onto a DSM (digital surface model), and then allows the user to edit and reshape them to their accurate, true, real-world positions. During the collection of GIS data, the spatial and non-spatial attribute information associated with a GIS layer can be edited, and the attribute tables can be displayed with the DSM. Automated attribution techniques simultaneously populate the GIS during the collection of 3D data. Stereo Analyst directly outputs ESRI 3D shape files for immediate use in ERDAS IMAGINE and ESRI GIS products.

IKONOS Sensor Model Support for ERDAS IMAGINE V8.5 provides users with the ability accurately to ortho-rectify, extract DTMs, and collect 3D GIS vectors using IKONOS imagery. IKONOS images provided with an Image Geometry Model (IGM) can be transformed into value-added GIS products using ERDAS software. IMAGINE Advantage can be used to accurately adjust and ortho-rectify single frame IKONOS images. IMAGINE OrthoBASE can be used to adjust and ortho-rectify multiple overlapping IKONOS images. IMAGINE OrthoBASE Pro can be used to automatically extract DTMs using multiple overlapping IKONOS images. ERDAS Stereo Analyst can be used to interpret, collect and visualise map-accurate 3D geographic information using overlapping IKONOS images.

For more information contact ERDAS (telephone: +1-404-248-9000) or visit the website: www.erdas.com.

4.7 EURIMAGE Business Development Initiative

Eurimage is introducing a new programme, the Eurimage Business Development Initiative (EBDI), to support value-adding companies in the development of products and services using datasets from ERS SAR, the upcoming ENVISAT mission, and others, for targeted market sectors. In view of the launch of ENVISAT in early 2002, and the increased opportunities this new mission will bring, Eurimage's goal with the EBDI programme is to work more closely with the value-added industry to further develop the potential market for Earth observation (EO) products and services.

Eurimage's contribution in this first phase will cover: improved pricing on ERS data; improved pricing on other datasets available from Eurimage; data searches (includ-

ing screening of available Quick Looks and provision of selected interferometric Quick Looks); application and technical assistance. To launch the programme Eurimage is introducing a special discount, starting at 50%, for a minimum of ten products, for orders placed before 15 December 2001.

Value-adding companies wishing to participate in the programme will be required to provide the following information: project description; target market sector(s); client type(s); type of products and services. All information provided will be kept confidential. This is only the first phase of the EBDI, which will be complemented by other initiatives in the coming months, and with the arrival of ENVISAT. For larger volumes, even better conditions may be available. Contact the following Eurimage representative to learn more about this programme, and the support Eurimage can provide in further developing the EO market: Luciana Di Domenico, ERS / ENVISAT Business Development Manager (e-mail: didomenico@eurimage.com). Full details at: www.eurimage.com

Conditions: the 50% discount is applicable to single scene products for data held at an ESA PAF (worldwide coverage available); ad hoc discounts will be applied to data held at selected non-ESA ground stations; single orders must be for a minimum of ten products (PRI, RAW, GEC, SLCI or SLCQ); no other discounts (Application Provider, Packages, Special Offers, etc.) will apply; advance payment may be required; standard Eurimage Terms and Conditions of License apply.

4.8 EFI Launches Forest Disturbance Database

The European Forest Institute (EFI), together with Alterra (Wageningen, The Netherlands), has recently launched the Database on Forest Disturbances in Europe (DFDE). This database aims at providing historic information about disturbances in the forests of Europe. The information in this database is collected by means of a literature review, both from scientific papers as well as from "grey" literature. Each reference to a disturbance event is put in a single record, containing information on year of occurrence, exact date, country, region, district, disturbance type, tree species affected, volume, area, number, percentage, under-bark / over-bark, other comments and the literature reference. The user can search the database by country, year or period, and disturbance type group (abiotic, biotic, anthropogenic). The functionality to search on a more detailed level will be added soon. Although the information in the database is already quite extensive (about 27,000 records from 400 literature references), it still has gaps. The user is kindly invited to indicate additional sources of information, so that we can increase the coverage and accuracy of the database. The database is freely accessible at the web-site: www.efi.fi/projects/dfde

Report by Mart-Jan Schelhaas, from Forest Information Update Vol. 2, No. 31.

4.9 New On-Line Baltic Land Cover Maps

Through the joint efforts of two EU-supported projects, new and detailed land cover information from all around the Baltic Sea is now freely available on the web, to everybody interested, through the Baltic Environmental Atlas. The web-site to visit is maps.grida.no/baltic/

Land cover and land use are known to be main factors explaining much of the so-called "diffuse pollution" of nutrients in the Baltic Sea. Detailed information on land cover and land use types are thus of considerable interest to all concerned with eutrophication and the health of the Baltic Sea. The information is also of value for regional planning and analysis of other environmental issues.

The two projects making this information available to the public are the BALANS and BOING projects. The BALANS project, co-ordinated by Metria Miljöanalys, has recently completed a new GIS database on land cover derived primarily from medium resolution satellite imagery. The BOING project, co-ordinated by UNEP / GRID-Arendal, has developed a prototype internet- and indicator-based information

service dealing with eutrophication of the Baltic Sea. The Baltic Environmental Atlas has been developed as part of this project. Different types of land cover information developed within the BALANS project have been made available. The interactive map allows users to overlay the land cover maps with other information, and to zoom in to any area of interest in the region. For those in need of ready-to-use map graphics of the entire region, this is also available. For professional users, data for use in GIS are provided.

For on-line information, visit these web-sites: maps.grida.no/baltic/ (interactive map of the Baltic Sea region); www.grida.no/baltic/htmls/related.htm (ready-to-use maps and GIS data); balans.satellus.se (the BALANS Project); boing.fimr.fi (The BOING Information Service). For more information contact: Birgitta Olsson, Metria Miljöanalys (telephone: +46-8-5799 7270; e-mail: birgitta.olsson@lm.se) or Hugo Ahlenius, GRID-Arendal (telephone: +47-370-35713; e-mail: hugo.ahlenius@grida.no).

4.10 WRI's New Environmental Information Portal

The Environmental Information Portal (earthtrends.wri.org) is a free, interactive on-line resource, developed by the World Resources Institute (WRI). It provides environmental and sustainable development information to a worldwide audience of individuals in government, private industry, and international organisations who work on environmental policy. It also provides educators and students with material readily available to meet their educational and research needs. Ten key topics, ranging from coastal and marine ecosystems to population, health, and human well-being, include information, in yearly increments, for 210 countries and more than 400 variables. Navigation is straightforward. By choosing one of the ten topics, you can search the database or select one of the data tables, maps, country profiles, or feature articles about your chosen topic. We hope you will visit the site and let us know what you think.

Report by Marissa Irwin (WRI).

4.11 Global Forest Resources Assessment 2000

The Global Forest Resources Assessment 2000 (FRA 2000) provides a comprehensive, up-to-date view of the world's forest resources at the end of the second millennium. It is the result of the collective efforts of the countries of the world. This major undertaking was based primarily on information provided by the countries, supplemented by state-of-the-art technology to verify and analyse the information and to make the results accessible to the world via the internet. The FRA 2000 process emphasised collaboration and transparency. Special efforts were made to transfer technology to, and increase the capability of, countries that lack adequate capacity to assess their own forest resources. Extensive consultations were carried out with experts, and partnerships were forged with leading institutions from both developing and industrialised countries. FRA 2000 is a key data-source for the State of the World's Forests 2001, which reports every two years on the status of forests, recent major policy and institutional developments and important issues concerning the forest sector.

The FRA 2000 main report is available at the web-site: www.fao.org/forestry/fo/fra/main/index.jsp To purchase this publication contact: FAO Sales, Viale delle Terme di Caracalla, I-00100, Rome, Italy. E-mail: publications-sales@fao.org. Web: www.fao.org/catalog/giphome.htm. For more information contact: Peter Holmgren, Senior Forestry Officer, Global Forest Assessments, Forestry Department, Food and Agriculture Organisation of the United Nations (FAO), Rome, Italy. Telephone: +39-06-57052714 Fax: +39-06-57055825 E-mail: peter.holmgren@fao.org.

5 REVIEWS, PUBLICATIONS AND REPORTS

5.1 New CD-ROM of Two EARSeL SIG Workshops

The Proceedings of the two specialist workshops held in Dresden on 16-17 June 2000, are now available on a CD-ROM. One workshop dealt with Lidar Remote Sensing of Land and Sea, and the other with Remote Sensing of Land Ice and Snow. This is the first in the new EARSeL series of eProceedings, containing the peer-reviewed papers of workshops organised by the EARSeL Special Interest Groups (SIGs). Participants in these workshops will receive a copy of the CD-ROM, as will EARSeL member laboratories. The eProceedings may also be purchased through the EARSeL Secretariat, price 16 euros, including postage and packing.

5.2 Workshop (Italy): Urban RS and Data Fusion

Report on the IEEE / ISPRS Joint Workshop on Remote Sensing and Data Fusion over Urban Areas, held in Rome on 8-9 November 2001

Niall McCormick, Institute for Environment and Sustainability, LUC Unit, European Commission, DG-JRC, Italy

A major international workshop on the subject of "Remote Sensing and Data Fusion over Urban Areas" was held in the beautiful surrounding of the University of Rome "La Sapienza" – Faculty of Engineering, in Rome, Italy, on 8-9 November 2001. The two-day workshop was organised jointly by IEEE / GRSS (Institute of Electrical and Electronic Engineers / Geoscience and Remote Sensing Society) and ISPRS (International Society for Photogrammetry and Remote Sensing), with the technical support of EARSeL, Universita degl Studi di Pavia, University of Rome "La Sapienza", and ASPRS (American Society for Photogrammetry and Remote Sensing), and sponsored by AIT (Italian Association for Remote Sensing), ESA (European Space Agency), ASI (Italian Space Agency), ImageSat International, IPT (Informatica per il Territorio S.r.l.), SchlumbergerSema, and Telespazio.

The workshop attracted one hundred and fifty registered participants from all over the world, and consisted of an opening session, seven technical oral sessions, two technical poster sessions, and a closing session. 104 abstracts had been originally submitted, from Europe (76), USA (14), Asia (7), Africa (5), and Australia (2). Following a review process, in which each paper was assessed by three reviewers, seventy-four papers were selected for presentation at the workshop. The accepted papers were divided into thirty-eight oral presentations and thirty-six poster presentations, plus one commercial presentation (by SchlumbergerSema).

In the Opening Session of the workshop, participants were welcomed to the University of Rome "La Sapienza" by Prof. Tullio Bucciarelli (the Conference Chairperson). The Opening Session was also addressed by Prof. Olaf Hellwich (Conference Co-Chairperson), Mr. Paul Smits (IEEE Data Fusion Committee Chairperson), Mr. Paolo Gamba (Technical Chairperson), Mr. Pierfrancesco Lombardo (Technical Co-Chairperson), and Ms. Debora Pastina (Organising Committee Chairperson).

The first five technical oral sessions of the workshop dealt with scientific advances in the many different techniques and data that are used in remote sensing and data fusion for urban areas. The last two technical oral sessions addressed various issues related to practical urban applications of remote sensing and data fusion. Specifically, the seven technical oral sessions were focussed on the following themes:

- New observation capabilities for urban areas
- Two-dimensional detection and classification
- Interferometric SAR observation of

urban structures
- Three-dimensional urban modelling and re-construction
- Data fusion over urban areas
- Remote sensing as input for decision-making / planning activities
- Urban remote sensing applications

An outstanding feature of the workshop was the high technical quality of all of the oral and poster presentations. This was undoubtedly partly due to the effective reviewing procedure that had been employed in selecting the papers, and to the well-defined structure of the workshop. The success of the workshop was also helped by the active participation of an interested and motivated audience, as reflected by the variety of questions from the floor that followed each presentation.

The workshop's programme included a gala dinner in a beautiful restaurant in the vicinity of Rome's Pantheon. The excellent dinner, which was sponsored by the European Space Agency, provided the participants with an ideal setting for socialising and discussion, in a convivial and informal atmosphere. Interaction amongst the participants was also facilitated by the workshop's sumptuous coffee- and lunch-breaks.

A copy of the workshop's full proceedings, containing all of the papers (both oral and poster), was provided at registration to each participant, in hardcopy and CD-ROM form. For information on how to obtain the proceedings, contact the workshop's Technical Chairman: Dr. Paolo Gamba, Department of Electronics, University of Pavia, Via Ferrata 1, 27100 Pavia, Italy (telephone: +39-0382-505781; fax: +39-0382-422583; e-mail: p.gamba@ ele.unipv.it; web: tlc.unipv.it/~gamba/).

In conclusion, everybody involved in the workshop – both organisers and participants – should be congratulated on contributing to a successful, stimulating, and enjoyable event, which has certainly provided the incentive for further research and collaboration in this important field. More information is available on the workshop's web-site: tlc.unipv.it/urban_2001/ (Note: see also the following article).

5.3 Special issue: Int. J. of P'gramm. and RS

Dear Colleagues,

Following the successful IEEE / ISPRS joint workshop on Remote Sensing and Data Fusion over Urban Areas, held in Rome on 8-9 November 2001, we are pleased to announce the following call for papers:

- ISPRS Journal of Photogrammetry and Remote Sensing: Theme Issue on "Algorithms and Techniques for Multi-Source Data Fusion in Urban Areas". Elsevier Publication. April 2003 (planned publication date). Guest Editors: Paolo Gamba, University of Pavia, Italy; Olaf Hellwich, Technical University Berlin, Germany; Pierfrancesco Lombardo, University of Rome "La Sapienza", Italy.

The theme issue will focus on the algorithms and techniques particularly suited for multi-sensor data analysis in urban areas. All sensor types (optical, thermal, laser, SAR) and platforms (close-range, aerial, spaceborne) may be addressed. No work on fusion of geodata and imagery for revision and updating purposes will be considered, due to another theme issue on this topic planned by ISPRS Commission II for early 2004.

The following topics will be particularly addressed: multi-sensor imagery / information / data fusion techniques suited for urban areas; co-registration issues (regarding different sensors in urban areas); multi-resolution / scale-space and multi-temporal issues; DTM and DSM generation; detection and 3D object reconstruction (buildings, roads, vegetation etc.); generation of 3D City Models.

The paper must be an original contribution, not published in or submitted for publication to other journals or conference proceedings, and must follow the instructions for authors described in the ISPRS web-site (www.photogrammetry.ethz.ch/journal).

Please submit the full manuscript in electronic form (Word or PDF) to the e-mail address below, by 30 June 2002: Dr. Paolo

Gamba, Department of Electronics, University of Pavia, Via Ferrata, 1, 27100 Pavia, Italy. Telephone: +39-0382-505781, fax: +31-0382-422583; e-mail: p.gamba@ ele.unipv.it; web: tlc.unipv.it/~gamba (personal page); web: ele.unipv.it/~tlc/index_ RS.htm (remote sensing lab page).

Yours sincerely, Paolo Gamba, Associate Professor, Department of Electronics, University of Pavia, Italy.

5.4 RSPSoc Annual Conference 2001 in London, UK

Report on the 1st Annual Conference of the Remote Sensing and Photogrammetry Society (RSPSoc) held in London, UK, on 12-14 September 2001

Dr. Robin Vaughan (University of Dundee) and Madeleine Godefroy (EARSeL Secretariat)

The 1st Annual Conference of the merged Remote Sensing and Photogrammetry Society (RSPSoc) was held on 12-14 September 2001 at the Conference Centre of the UK Department of Trade and Industry, which is very near Westminster Abbey in the heart of London. After the merger the RSPSoc, as it is now known, totals some 1200 members, including nearly seventy corporate members. The main sponsors of the meeting were the British National Space Centre, Astrium, and the Ordnance Survey, which is the official mapping agency of the UK. The centrally situated venue offered excellent facilities, which attracted around 260 participants, mainly from the UK, but also from abroad. The tragic events in the United States on 11 September overshadowed the meeting, and prevented some speakers from attending. Nevertheless the programme ran smoothly.

After the ice-breaker reception on 12 September, those delegates who had prebooked were able to take a bird's eye view of London on a flight on the London Eye, a giant wheel installed on the banks of the Thames, that takes passengers to an awe-inspiring 135 metres, offering unique views across the city and beyond.
The meeting allowed many contacts to be renewed and others made. The ISPRS Council held a meeting in London prior to the conference, hosted by their Secretary General, Prof. Ian Dowman. This enabled several ISPRS Council Members to attend and contribute to several sessions of the conference, and indeed to raise the profile of the meeting. John Trinder (President of ISPRS), Costas Armenakis (President of Commission IV), Tania Maria Sausan (President of Commission VI), and Rangnath Navalgund (Director of ISRO and President of Commission VII) all spoke at plenary sessions. Other keynote talks were given by Colin Hicks, Director of BNSC, Jacquie McGlade, of the Environmental Agency, Vanessa Lawrence, Director General and Chief Executive of the Ordnance Survey, and Nigel Press of NPA. The latter showed a harrowing image of the damaged Pentagon Building, downloaded via his WAP phone an hour earlier!

Other well-attended parallel sessions covered natural hazards, algorithms, modelling, oceans and climate, land use and land cover, photogrammetry, environmental impact, SAR, small satellites, GIS and the web, and airborne remote sensing. Special sessions were also held by BARSC (British Association of Remote Sensing Companies) and on the LANDMAP project. Some excellent posters were displayed at the poster session, and there was an optional visit to Surrey Satellite Technology Ltd after the closing ceremony. At the AGM of the Society, a completely new Council was elected to replace the interim joint Council which had been in place since the merger of the two former societies took effect earlier in the year. Dr. Ian Downey of the Natural Resources Institute, University of Greenwich, was elected as Chairman and Dr. Jon Finch as Honorary Secretary.

The traditional awards ceremony was followed by a gala dinner in the Church House, adjacent to Westminster Abbey. At the awards ceremony, Dr. Robin Vaughan, who served for many years on the Council of the Remote Sensing Society, and who was until recently Chairman of EARSeL, was presented with the Society's gold medal by Lord Hesketh, Honorary President of the RSS. The award was for outstanding services rendered to the ad-

vancement of remote sensing techniques and to the Society. Congratulations, Robin!

The organisers, and in particular Philippa Mason and Karen Laughton, are to be thanked and congratulated for their hard work and competence, which resulted in a smoothly run and most enjoyable meeting.

5.5 Workshop (Hungary): World Heritage Sites

Report on the Workshop on Global Monitoring of World Heritage Sites, held in Sopron, Hungary on 6-8 September 2001

Peter Winkler (Member of "SPACE and TIME" Organising Committee; contact for ISPRS WG VII/4) and Pal Levai, FOMI, Budapest, Hungary

The Department of Geoinformatics, College of Surveying and Land Management, of the University of West Hungary (CSLM-UWH) organised the "SPACE and TIME" Thematic Workshop in Sopron, Hungary, on 6-8 September 2001. The organiser of the conference, which was held in the tastefully renewed Hotel Pannonia, was Prof. Dr. Bela Markus, Director General of CSLM-UWH.

The thematic workshop was structured in four sessions with thirty-two presentations. The sessions were organised in the following themes (with names of chairman and rapporteurs, and the number of the presentations): (a) Challenges (Bele Markus – Diane Evans, 10); (b) Data Integration and Monitoring (Rangnath Navalgund – Carsten Jürgens, 8); (c) Decision Support (Ferenc Nemeth – Allan Brimincombe, 9); (d) Information Services (Henk Scholten – Tom Poiker, 5).

The main objective of the Thematic Workshop was to bring together scientists and interested parties to discuss aspects of monitoring and change detection of world heritage sites, and to improve disaster-monitoring capacity for site managers and national authorities. Remote sensing (RS) and GIS, together with the cultural resource management (CRM) community, cannot play separately the role required by governments, municipalities, local communities, investors, and developers, who are involved at world heritage sites. Synergy of the scientific facilities is the key to sustainable resource management at the world's most precious cultural and natural beauty sites. Research communities and universities need to co-operate closely with the key stakeholders, for the benefit of all.

During the conference time an attractive parallel exhibition showed the current and the candidate world heritage sites of Hungary. Huge and brilliant photographs and short descriptions explained the most valuable Hungarian places of interest. Various sponsors helped the success of the conference: UNIGIS Hungary; EUROGI; ISPRS; EARSeL; College of Geoinformatics; ESRI; University of West Hungary; CIPA-International Committee for Architectural Photogrammetry; International Council for Monuments and Sites; INTERGRAPH Hungary; Ministry of Education; Hungarian Association of Geo-Information; All of the presentations were published on a CD-ROM, distributed during the conference. The full "SPACE and TIME" conference material and information are available on the web-site: www.cslm.hu

5.6 Workshop (Italy): RS by Low-Frequency Radar

Report on the Workshop on Remote Sensing by Low-Frequency Radars, held in Naples, Italy, on 20-21 September 2001

Dr. Simonetta Paloscia, IROE / CNR, Florence, Italy

EARSeL, together with CO.RI.S.T.A. (Consortium of Research on Advanced Remote Sensing Systems), organised a workshop on low-frequency radars, in the magnificent scenario of Castel dell'Ovo and the Gulf of Naples. The topic dealt with the increasing expectations of the scientific community for the interesting characteristics of this type of sensor (which operate down to HF frequencies) due to the high penetration. In recent years, the range of applications of Low-Frequency Radar (LFR) systems has rapidly increased, and

extends to archaeology, ecology, environment, geology and geophysics, glaciology, oceanography, and planetology.

The meeting was organised over two days and was hosted in Naples at the Hotel Vesuvio. Although the tragic terrorist attacks in New York and Washington caused some absences amongst the US speakers, the programme, which had to be somewhat rearranged with respect to the original plan, turned out to be consistent and exhaustive.

The meeting was mainly dedicated to applications, and covered various aspects, from mineralogical prospecting and the identification of minerals, for both lithology and more industrial activities such as gold mines, to the hydrological purposes which benefit from the high penetration in vegetation cover for obtaining information on forest biomass and moisture of fairly deep soil layers. Further applications also dealt with archaeology and mine detection for humanitarian purposes. Some papers were dedicated to new technologies for space-borne low-frequency radars.

On Thursday, after the welcoming speech by Prof. Sergio Vetrella, President of Corista, there was an opening presentation by Dr. Mancini (ESA) concerning ESA's past, present and future activities in space-borne radars (e.g. ERS, ENVISAT, Earth Watch). The presence of an L-band SAR within the framework of the Earth Watch Programme is an encouraging sign for the scientific community involved in the Earth's applications, after the long series of C-band radars of ESA and other international agencies. Another short welcoming speech was given by Dr. Somma of Alenia Spazio, which was involved with Corista in the meeting organisation, and sponsored the meeting together with ASI (Italian Space Agency), ESA, CNR (National Research Council), Italian Ministry of University and Scientific and Technological Research, the Second University of Naples, and the University of Naples Federico II. After the opening session, the meeting got started with its first session, chaired by Dr. Diane Evans of JPL on behalf of Dr. Charles Elachi, Director of JPL, who was unable to attend the meeting.

Many papers were focused on the high penetration characteristics of LFR, both airborne and ground based, often pulled by trucks. Among the applicational aspects, only one paper dealt with lithology, with an overview of SAR (mainly ERS) capabilities in identifying lithological layers. A few presentations concerned the estimation of hydrological parameters, such as forest and crop biomass, and soil moisture. Archaeology had a particular focus, in both oral and poster presentations, since GPR represents an important tool capable of indicating the right site in which excavations can be directed. Some papers were dedicated to the French instrument MIMOSA, a space-borne P-band SAR, regarding both technical aspects of a new approach for large P-band antennas from space, and possible applications (i.e. polar caps and paleo-channels of Mars). An interesting topic, presented by Alenia Spazio, was a new airborne VHF SAR for archaeological applications. This type of sensor could be very interesting if made available for experimental activities of the scientific community. The final session on Friday was mostly devoted to the Mars Advanced Radar for Sub-Surface and Ionosphere Sounding (MARSIS), within the framework of the Mars express mission. Several interesting posters were shown close to the session room, and a reasonable amount of time after the coffee-breaks was dedicated to viewing the posters and discussions with the authors.

A particular note of appreciation must be expressed for the highly-efficient secretarial collaboration of the as-ever irreproachable Ms. Godefroy (ça va sans dire) and the very kind and professional Ms. Anna Bice Rosa Rosa of Corista and Ms. Anna Maria Esposito, who managed all the local arrangements. The Proceedings of the workshop, on CD-ROM, are now available, and will be distributed to participants very shortly.

5.7 Conference (Italy): Dangerous Goods, Relief

Report on EURISY Conference "Management of Dangerous Goods Transport and Relief Convoys: Integrating the Space Solution", held in Naples, Italy, on 18-19 October 2001

Valerie A. Hood, Secretary General, EURISY

EURISY and the Italian Space Agency (ASI) organised a conference, "Management of Dangerous Goods Transport and Relief Convoys: Integrating the Space Solution", in Naples on 18-19 October 2001. Sponsorship was given by ESA, Trenitalia, TSF SpA, Telespazio, Alenia Spazio, and Regione Campania. The venue of the conference was the Castel dell'Ovo – an idyllic setting which, combined with perfect weather, made the occasion unforgettable for the participants.

The events of 11 September were very much in the minds of the participants, especially the user community, which was well represented and in many cases was already using space technology on a routine basis. Topics covered included Safety and Competitiveness, Regulations, Specific Applications on Land and Sea and Technologies. There were 130 participants from twelve countries ranging from Syria to Norway. There was a general consensus that the Galileo programme would be of invaluable assistance to the user community for operational purposes, since it will provide higher reliability in a single system and will be under European control.

5.8 Workshop (Belgium): Landscape Aerodynamics

Report on the VITO Workshop "Landscape Heterogeneity and Aerodynamic Roughness: Modelling and Remote Sensing Perspectives", held in Antwerp, Belgium, on 12 October 2001

Herman Debie, SAR-projects, VITO, Mol, Belgium

This workshop, organised by VITO (Flemish Institute for Technological Research) and co-funded by ESA, was attended by around thirty participants, mainly from Belgium and The Netherlands, but also from Denmark, France, Germany and ESA / ESRIN. The workshop presented some applications of the quantification of the impact of landscape on wind-field by means of remote sensing (RS). In this way, the workshop was aimed at making the "atmospheric modelling community", aware of the possibilities of RS.

Koen De Ridder (VITO) presented an upgrade of the OPS model (developed at RIVM, The Netherlands) to predict pollutant deposition, especially in heterogeneous terrain and at forest edges. Herman Debie (VITO) presented an interface to this upgraded model, but with input from texture parameters of SAR imagery, instead of land cover maps. Charlotte Hasager (Risoe, Denmark) presented the surface flux aggregation in heterogeneous terrain on the micro-scale using RS data (infrared). Albert Olioso (INRA, France) presented the spatial distribution of evapo-transpiration and aerodynamic roughness from infrared RS. Joost de Jong and Wim Klaassen (University of Groningen, The Netherlands) presented the measurement of aerodynamic roughness by laser altimetry (small scale). The main conclusion of the workshop was that the RS technique used largely depends on application and scale (deposition of pollutants, wind turbine location, etc.). Most likely, a combination of techniques is recommended (e.g. laser altimetry and SAR). Second-order statistics (the way that variance is related to distance and expressed, for example, as the "power spectrum") is certainly recommended, and gives additional information, compared to first-order statistics (e.g. standard deviation).

The Proceedings of the workshop will be available at the end of the year, free of charge, either in hardcopy or on CD-ROM. Contact: VITO / TAP (June Cools), Boeretang 200, B-2400, Belgium.

5.9 Symposium (Syria): RS in Arab Countries

Report on the Symposium "International and Arab Co-operation in Remote Sensing", held in Damascus, Syria, on 28 October – 1 November 2001

Leonid Vasiliev, Institute of Geography, Russian Academy of Sciences, Moscow

The General Organisation of Remote Sensing (GORS) hosted, in the Syrian capi-

tal Damascus, the 12th international symposium "International and Arab Co-operation in Remote Sensing and Space Research", from 28 October – 1 November 2001. It was opened under the patronage of the Prime Minister, Dr. Mohamed Moustafh Miro. The State Minister for Technology Transfer and Development, Dr. Ihssan Chrietah, deputised for the Prime Minister. The opening ceremony was attended by the Minister for Irrigation, Taha Al-Atrash, the State Minister of the Red Cross, Mokhowal Abo Hamedah, and other officials.

The distinguished role GORS plays in remote sensing (RS) in the Arab world and in the Arab League encouraged about 400 participants from fifteen countries to attend the symposium. It is worth noting that GORS is an EARSeL member, and its Director General, Dr. Eng. Hussein Ibrahim, has participated in EARSeL Symposia and Council Meetings during recent years. GORS Symposia have become today a melting pot in the Arab world. This achievement is due to its activity in international and Arab co-operation in RS research and application, through annual symposia since 1990 that GORS has wholly organised. From the beginning, Prof. Gottfried Konecny (Germany) was involved in the promotion of the GORS initiative, advocating the setting up of an effective system based on international co-operation in RS among Arab countries. With profound insight, he stressed the need for scientific co-operation between the RS community and international organisations dealing with earth sciences – IUGG, IGU, EARSeL, to name just a few.

Some researchers from Syria, and from Austria, Belorussia, Canada, Egypt, France, Germany, Iran, Lebanon, Libya, Russia, Spain, Tunisia, Turkey and Yemen, delivered important lectures on the topic of the Symposium. The Symposium consisted of four themes: (1) the variety of scientific international co-operation in Arab world on multi- and bilateral levels (this point was illustrated by some examples of using RS for the determination of environmental changes, land use, desertification, crop monitoring, and estimation of evapo-transpiration); (2) the International project Geological Application of Remote Sensing (GARS); (3) a new way of designing small satellites for science and education; (4) the establishment of an observatory in Syria in co-operation with the Syrian Astronomical Society.

Recently, the Arab League Educational, Cultural and Science Organisation (ALECSO) started a co-operative program to build a common approach in using RS for desertification monitoring and coastal zone studies. A special session, focussed on the new GARS project in the Arab world, recognised the importance of linking local research programmes into regional research topics. GARS has recognised that Arab countries experience a very wide range of problems associated with desertification and the coastal zone. However, the priority will first address the basic aims – hydro-geology. Dietrich Bannert (Germany), President of the GARS program, outlined the role RS could provide in integrating the base information which has to be supported by all hydro-geological models for the whole region. The regional importance of RS in the field of hydro-geological applications was clearly demonstrated by researchers from Syria, Lebanon and Egypt. In the framework of GARS, Syria and Lebanon are already involved in a joint hydro-geological research on a regional level.

The Space Research Institute (IKI) in Moscow, the German Aerospace Centre (DLR) in Berlin, and the Scientific and Technical Council of Turkey, presented their results of small satellites activities in the field of academic research, teaching and commercial application. DLR had launched a small satellite, BIRO, on the October 22, 2001, on an Indian rocket PSLV-C3 together with the Indian main satellite TES for fire detection and monitoring.

The final part of the programme was a display of the atlas of Syrian history, made from high quality space images and produced in co-operation between GORS (Syria) and Geospace (Austria), which made a deep impression. "It is like an open-air Museum" said Dr. H. Ibrahim. The atlas is being further developed.

The Symposium has made measurable progress in international and Arab co-operation in RS, and allowed the exchange of ideas among researchers involved in basic Earth sciences and those whose work is application-oriented. The participants confirmed the necessity to widen Arab co-operation in Earth sciences, the environment, RS and GIS and education in universities, environment civil engineering, geography, geology etc., in the League of Arab Countries. A technical exhibition, featuring the latest in mapping, software, GIS, books and services, was held during the Symposium and allowed all participants an opportunity to view the exhibits.

5.10 Workshop (USA): Airborne Laser Hydrography

Report on the Airborne Laser Hydrography Workshop, held at the Stennis Space Centre, Mississippi, USA, on 15-17 August 2001

Dr. Rainer Reuter, University of Oldenburg, Germany

On 15-17 August 2001, the 2nd Airborne Laser Hydrography Workshop was held at the Stennis Space Centre, Mississippi, USA. Organised by the Naval Oceanographic Office and the Joint Airborne Lidar Bathymetry Technical Centre of Expertise, it followed a very successful event held in summer 2000. The goals of the meeting were (a) to summarise the experience obtained with airborne lidar bathymetry, since this became operational in the mid 1980s in Canada and in Australia, for water-depth measurements; (b) to investigate the potential of further detection capabilities, which can be made available as value-added capabilities in addition to water-depth measurements; (c) to outline the capabilities of the new SHOALS 1000 laser bathymeter, which is at present under development at Optech Inc., Canada.

It was emphasised that, in recent years, nautical and tactical charting has become a very important task for hydrographic offices worldwide. Conventional shipboard acoustic echo-sounding is mostly replaced by sonar surveys, which allow for a high resolution acoustic imaging of the sea-floor in coastal shipping routes and harbour areas. US authorities expect a 2500 Gbyte / year volume of side-scan and multi-beam sonar data in 2002 and beyond. Since acoustic imagery of the sea-floor was not in use before 1997, this situation requires new approaches to process and archive the data, and to make these nautical charts easily available to the users in future.

At water depths of less than 30 metres, and in regions where the water transparency is high, surveys can be very efficiently carried out using airborne lidar bathymetry. The use of lasers with high pulse repetition rate and scanners for across-flight track pixel detection, leads to a good coverage on the ground. Along with the high aircraft speed, this makes it a very economic tool for bottom-depth measurements over large coastal areas. Moreover, airborne bathymetry can be done near shore-lines and in other very shallow areas that are not accessible by ship, for acoustic bottom topographic measurements. With the instruments available today, data evaluation is done in real-time. Meeting the accuracy demands of nautical charts in shallow water areas requires a careful post-flight data quality analysis. This results in an absolute vertical accuracy of ±25 centimetres. In the workshop, the results of airborne surveys performed in recent years with the SHOALS lidar bathymeter of the US Army Corps of Engineers in Hawaii, Florida, and in coastal waters of Portugal, demonstrated the performance of this instrument.

However, there are still some limitations of airborne laser bathymetry, which requires more research and testing. The capability of locating small objects such as rocks and wrecks on the bottom, which are a risk for ship traffic, is still a challenge. A detection of objects of about one cubic metre in size has been demonstrated, but this depends on the sea surface state, the bottom reflectivity, and other parameters. At present such targets are still more safely identified with ship-borne sonar. Similarly, the topographic mapping of beaches is difficult because of the very shallow water depth, making a separation of water surface and bottom return pulses difficult. White caps from breaking waves can obscure the sea-floor, thus making measurements near the shore-line often difficult. This

holds also for sediments that are easily suspended due to turbulence from breaking waves. However, near-shore surveying was considered an efficient tool for gathering data on changes of the coastline topography, which are relevant for shore-line protection. Therefore, efforts will be directed towards new approaches to overcome these limitations in the future.

A most accurate detection of laser pulses reflected on the water surface is a prior condition for calculating water depths from the bottom-reflected return signal. While the latter is done with the elastically scattered laser wavelength, the sea surface is tracked using the laser-induced water Raman scattering, since this indicates the air-water interface unambiguously. However, with the mostly used 532 nanometres emission wavelength from NDYAG (*Editor's note: an acronym for the amasing phrase: neodymium-doped yttrium-aluminium-garnet*) lasers, the water Raman scatter wavelength in the red at about 650 nanometres is a relatively weak signal. A much stronger water Raman signal could be detected with an additional laser excitation in ultra-violet. In addition, a detection of fluorescent hydrocarbons (e.g. mineral oils) in the upper water-column can be achieved. Another topic which could increase the number of parameters to be measured with lidar is the study of the sea-surface structure. Laser-based 3D imaging of surface topography can be directly interpreted in terms of spatial and directional properties of surface wave-fields. Furthermore, a 3D imaging of objects in the water-column has been suggested by using a streak tube camera as a detector. Thus, there is a large number of value-added products, which increase the already existing capabilities of airborne laser bathymetry.

A substantial part of the workshop was devoted to the new SHOALS 1000 instrument, which is at present under development at Optech Inc., Canada, for use by several hydrographic agencies. In the hydrographic mode, this instrument will have a good capability for small object detection due, to its 400 Herz pulse repetition rate. In addition, it will have a topographic mode with a 10,000 Herz pulse frequency at a lower energy level, allowing a simultaneous mapping of land surfaces. This instrument will be ready for operation in 2003.

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6 FORTHCOMING MEETINGS AND COURSES

6.1 Oceanography meetings: GODAE; Jason; DORIS

During the week of 10-15 June 2002, one symposium and two dedicated meetings, all related to the field of oceanography and ocean monitoring, will be held in Biarritz, France. The announcements for the three events are presented below. For further information, contact Capitole Tourisme Affaires – BIARRITZ 2002, 21 avenue de Fondeyre, 31200 Toulouse, France (e-mail: biarritz2002@cta-congres.com).

Global Ocean Data Assimilation Experiment (GODAE)

2002 will be a key year for oceanography. The Global Ocean Data Assimilation Experiment (GODAE) will pave the way for future operational ocean observation and forecasting systems. The symposium "En route to GODAE", from 13-15 June 2002 in Biarritz (France), will give participants the opportunity to present papers and discuss the strategy behind GODAE, its components and how they are to be implemented. More information is available from the web-site www.cnes.fr/BIARRITZ2002

Jason-1 Science Working Team

The members of the Jason-1 Science Working team will meet in Biarritz, France, on 10-12 June 2002, to review the first few months of Jason-1 operation and the transition with TOPEX / POSEIDON, the successful ocean observation mission since 1992.

Jason 1 is the follow-on to Topex / Poseidon, a US-French spacecraft that has been making precise measurements of ocean surface topography since 1992. These data are used to map ocean currents, improve the understanding of ocean circulation, measure global sea level change and improve global climate forecasts. For more information on Jason-1 go to the web-site: topex-www.jpl.nasa.gov/mission/jason-1.html

International DORIS Service (IDS)

The International DORIS Service (IDS) workshop will be held in Biarritz, France, on 13 June 2002, and will foster dialogue between users of the DORIS system, operational for over ten years now, in the area of orbit determination, accurate location and in other application fields.

DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) is a Doppler satellite tracking system developed for precise orbit determination and precise ground location. It is on board the TOPEX / POSEIDON altimetric satellite and the remote sensing satellites SPOT-2, SPOT-3 and SPOT-4. It will also fly with Jason-1, ENVISAT and SPOT-5. IDS is a project for an international service to provide a support, through DORIS data and products, to geodetic, geophysical, and other research and operational activities. The creation of IDS was initiated by the DORIS Pilot Experiment, to assess the need and the feasibility of such a service. For more information on IDS / DORIS go to the web-site: ids.cls.fr/

6.2 Calendar of Forthcoming Meetings

NEW
26 February – 1 March 2002, Kunming (Yunnan Province), China

International Workshop on Visualization and Animation of Landscape
Organised by: ISPRS Commission V, WG V/6 (Visualization and Animation).
Contact (manuscripts): Dr. Kiyoshi Honda, ACRoRS, AIT (Asian Institute of Technology), PO Box 4, Klong Luang, Pathumthani 12120, Thailand (telephone: +66-2-524-6149; fax: +66-2-524-6147; e-mail: honda@ait.ac.th). Contact (ISPRS): Prof. Dr. Armin Gruen, ISPRS WG V/6 Chairman (telephone: +41-1-633-3038; fax: +41-1-633-1101; e-mail: agruen@geod.baug.ethz.ch). Web: www.photogrammetry.ethz.ch/news/events/Call_for_Papers-Kunming2002.html

11-13 March 2002, Bern, Switzerland

3rd EARSeL Workshop "Observing our Cryosphere from Space: Techniques and Methods for Monitoring Snow and Ice with Regard to Climate Change".
Organised by Dr. Stefan Wunderle, Convener EARSeL SIG. E-mail: swun@giub.unibe.ch. Web: saturn.unibe.ch/rsbern.

NEW
8-11 April 2002, Toronto, Canada

The GEOTec Event – the Global Conference and Exhibition on Geospatial Technology, Tools, and Solutions
Contact: Matt Ball, Show Manager, GEOTec Media, Boulder, Colorado, USA. Telephone: +1-303-5440594. Fax: +1-303-5440595. E-mail: info@GEOTecEvent.com. Web: www.geoplace.com/gt.

NEW
20-22 May 2002, Miami, USA

7th International Conference "Remote Sensing for Marine and Coastal Environments
Contact: Veridian International Conferences Staff, Ann Arbor, USA. Telephone: 1-734-9941200, ext. 3234. Fax: +1-734-9945123. Web: www.erim-int.com/CONF/7th_marine/7th_marine.html

UPDATED
4-6 June 2002, Prague, Czech Republic

22nd EARSeL Symposium "Geoinformation for European-Wide Integration"
Organised by Dr. Tomas Benes, UHUL Forest Management Institute, Czech Republic. E-mail: benes@uhul.cz. Web: www.uhul.cz. (Followed by specialist workshop – see next item).

UPDATED
7 June 2002, Prague, Czech Republic

Specialist workshop: Remote Sensing for Environmental Modelling
Organised by Dr. Jan Kolar (e-mail: kolar@fsv.cvut.cz). Contact: EARSeL Secretariat (e-mail: earsel@meteo.fr; web: www.earsel.org).

UPDATED
11-13 June 2001, Istanbul, Turkey

3rd International Symposium on Remote Sensing of Urban Areas
Second Announcement. Contact: Prof. Dr. Derya Maktav, Symposium Chair (e-mail: dmaktav@ins.itu.edu.tr). See details at: www.ins.itu.edu.tr/rsurban3
Deadline for abstract submission: 15 December 2001

UPDATED
24-28 June 2002 Toronto, Canada

IGARSS Symposium "Remote Sensing: Integrating our View of the Planet"
Contact: Joseph M. Piwowar (e-mail: piwowar@uwaterloo.ca). Web: www.igarss02.ca

NEW
3-5 July 2001, Nice / Sophia Antipolis, French Riviera, France

TELEGEO 2002 – 3rd International Symposium
Contact: Tullio Tanzi (e-mail: Tullio.tanzi@cindy.cma.fr or Robert Laurini (e-mail: laurini@lisi.insa-lyon.fr). Web: www.isprs.org/specials/announc_PDF/Telegeo2002_01.pdf

NEW

16-19 Sept. 2002, Budapest, Hungary

6th Global Spatial Data Infrastructure (GSDI) Conference – From Global to Local
Contact (general information): EUROGI (e-mail: eurogi@euronet.nl. Contact (local arrangements): Gabor Remetey (e-mail: gabor.remetey@fvm.hu). Contact (GSDI): Alan R. Stevens (e-mail: astevens@gsdi.org). Web: www.gsdi.org.

NEW

16-18 September 2002, São José dos Campos, Brazil

ISPRS – Commission VI Mid-Term Symposium: New Approaches for Education and Communication
Contact: Tania Maria Sausen, INPE, Brazil. E-mail: tania@ltid.inpe.br. Web: www.isprs.org/specials/announc_PDF/First_Announcement_comm6_symp.pdf. Deadline abstracts: 15 January 2002

18-20 September 2002, Bonn, Germany

2nd EARSeL Workshop "Remote Sensing for Developing Countries"
Contact: Prof. Dr. G. Menz (e-mail: menz@rsrg.uni-bonn.de). Web: www.rsg.uni-bonn.de/earsel_2002/index.htm

UPDATED

19-23 Sept. 2002 Zakopane, Poland

Conference on GIS and RS in Mountain Environment Research
Organised by Jagiellonian University, Krakow and IUFRO.
Contact: Jagiellonian University, Institute of Geography and Spatial Management, Krakow, Poland. Telephone: +48-12-4230354. Fax +48-12-4225578. E-mail: confe2002@enviromount.uj.edu.pl. Web: www.enviromount.uj.edu.pl

23-24 September 2002, Antalya, Turkey

Remote Sensing of Mediterranean Coastal Areas
Contact: Prof. Merya Maktav, Istanbul Technical University, Turkey. E-mail: dmaktav@ins.itu.edu.tr

NEW

10-19 October 2002 Houston, Texas, USA

World Space Congress 2002 – Joint Meeting: 34th Scientific Assembly of COSPAR (Committee on Space Research) and 53rd International Astronautical Congress of IAF (International Astronautical Federation), IAA (International Academy of Astronautics) and IISL (International Institute of Space Law)
Contact: American Institute of Aeronautics and Astronautics (fax: +1-703-2647551 ; e-mail: wsc2002@aiaa.org). Web: www.aiaa.org/wsc2002.

NEW

3-6 December 2002, Hyderabad, India

International Symposium on Resource and Environmental Monitoring
Organised by ISPRS Technical Commission VII (Resource and Environmental Monitoring) and the Indian Society of Remote Sensing.
Contact: ISPRS TC VII Symposium Secretariat, National Remote Sensing Agency, Hyderabad, India. E-mail: isprstcvii@nrsa.gov.in. Web: www.commission7.isprs.org

3-6 June 2003, Gent, Belgium

23rd EARSeL Symposium
Contact: Prof. Dr. Rudi Goosens, University of Gent, Belgium. E-mail: rudi.goossens@rug.ac.be or earsel@meteo.fr.